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THE DEVELOPMENT OF PERCEPTION IN CHILDREN

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I. Introduction

IT is often difficult for adults to realize that children, even when they have learnt to run about and to speak, do not perceive the world around them in the same way as do adults. Children are so surprisingly quick to notice and comment on everything that goes on; yet at the same time the things they perceive, and the manner in which they perceive them, may differ quite considerably from the things we notice. It is perhaps particularly important for teachers of young children to recognize these facts clearly, and to allow for them in their teaching, since misunderstandings may occur when children seem wilfully to overlook or to make mistakes in perceiving what is shown them. Nor should it be forgotten that the ability to perceive in an adult manner develops probably more through maturation than through learning. True, the child requires certain experiences to expand and refine his perceptual capacities; but no amount of experience, nor even of direct teaching, can force him to proceed beyond the stage which he has reached through natural maturation.

It is often not at all easy to determine the stage of maturation. It does not depend solely on chronological age, but neither is it entirely a function of intelligence, particularly of intelligence as measured by an intelligence test. Emotional maturity is also of importance; and so is the experience which the child has gained from his physical and social environment. When in the subsequent discussion it is stated that children of a certain age in years can perform such-and-such a task, it must be understood that this age is merely an average. Many children will be either older or younger when they can first perform it.

II. Perceptual Development in Early Childhood

Before we examine the gradually developing perceptual abilities of the child when he first goes to school, it is important to consider the outlook of the pre-school child in perceiving the world around him. His main concern is with the objects and events he encounters in his ordinary everyday life, particularly those which are useful and interesting to him. He needs to know what things are; what they do; what he can do with them. Though in early infancy he has no understanding of the nature of his environment, nor what objects are like, he can discover a good deal, as Piaget (1955) has shown, by examining closely everything that comes within his reach, putting it in his mouth, manipulating it and exploring it with his fingers. In this way during his first year he comes to realize that objects are stable, solid, resistant to touch; and that they have a shape which remains the same although its visual appearance varies as he turns the object round in his hands. He knows also that objects retain their identity although their apparent size varies as they

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approach and recede from him; and that they continue to exist while they are out of sight. Before he realizes this, he tends to think that a hidden object has altogether disappeared, and seems quite surprised when it reappears. The realization of the continued existence of objects out of sight is very important to the development of understanding, since it enables the child not only to ask for things not perceived at the moment, but later to think and talk about them. Thus, Lewis's son at about 1½ years of age began to ask for chocolate hidden in a drawer (Lewis, 1937); but it was not until he was about 2 years old that he began to talk about past and future events unrelated to his immediate needs.

During his first year the child also begins to learn something about cause and effect (Piaget, 1955). He is extremely interested in pushing and pulling things and making them move about or rattle. But for some while he does not realize that it is necessary to touch them in order to do this, and sometimes he tries to " magic " them into moving by waving his hands at them from a distance. During his second year he also comes to understand that a moving object must touch another object to make it move in turn. Thus, even at this period he is extremely interested in finding out, as far as he is able, how and why things happen.

In his second year the child begins to use language to help him to understand and come to terms with his surroundings. Earlier, during his first year, vocalization is used primarily as a means of getting what he wants, crying when he is hungry or needs attention. Even his first words, " Mama," " go," " up," are really " word sentences," (McCarthy, 1930), expressing his desires and needs. Listening to, smiling at and babbling in response to human voices seems to be carried on in order to establish social contact with the people around him. Soon he finds that he can get what he wants more easily by asking people for it than by crying or grabbing. Also he often seems to enjoy babbling and repeating his early words as a form of vocal play, just as he enjoys waving his arms and legs and playing with his fingers and toes (Lewis, 1936).

The child's first words are most often names of objects, sometimes spoken in order to obtain these objects, but sometimes as a means of identifying an object and knowing what it is. It seems that the child establishes this identity in his mind by giving the object a name. At first the names are used for certain particular objects, but after a time for classes of objects. Thus, Lewis's son at about 9 months would look and reach for a small white ball when someone asked him, " Where's ballie? " (Lewis, 1936). But it was not until he was over a year old that he responded in the same way to a large coloured ball. However, as the child begins to encounter more and more objects, he comes to perceive that certain of them are alike. He hears adults calling these similar objects by the same name, and so he begins also to class them together and give them a common name. Thus, balls may be big or small, hard or soft, white or coloured; but they all have the same name. This classificatory procedure is extremely useful to the child, since instead of remembering the nature and identity of each separate object, he can, once he has classified them, perceive and recognize them as a group of things of similar behaviour and use (Vernon, 1952). Thus, balls are things which can be thrown and caught, and which bounce. When the child encounters a new object, he immediately tries to classify it and to know what sort of a thing it is. If he cannot do this, he asks, " What's that? "

Thus, we find that " What " questions begin towards the end of the second year, and are exceedingly frequent for the next two years (Smith, 1933).

Of course, at first the child makes many mistakes in classification and naming. A single name may be used for a number of objects roughly similar in appearance to which we give quite different names. Thus, one child learnt the name " moo-i " for the moon, and subsequently used it for various round objects and even for circles drawn on paper (Werner, 1948). Lewis's son used the word " tee " (kitty) for the cat, and also for dogs, cows, sheep and horses (Lewis, 1957). Later, he called his toy dog " goggie," but for some time retained the word " tee " for the live dog. About the same time he learnt the name " hosh " for a horse, and then applied it to a large St. Bernard dog. Thus, the child develops his own schemes of classification before he learns to name and use them in the way that we do.

As the child begins to know what things are, he becomes increasingly interested in what they do and what he can do with them and use them for. Thus, Valentine (1942) noted that his two-year-old daughter was constantly asking, " What this for? " A rather older child of five, when asked what various things were, described them in terms of use and function: " What is a hen? " " Something that lays eggs for you." The child also needs to acquire an understanding of how and why things happen, what people and things do and why. This is reflected in his questions as to how and why, which become increasingly frequent in the fourth and fifth years (Smith, 1933). Indeed, it has been calculated that at this period questions form 10-15 per cent. of everything the child says (Fisher, 1934). Even what appear to be statements of fact are often made with the intention of inviting confirmation or contradiction.

But in the process of classifying objects according to their appearance and use, there is naturally a tendency to overlook details which are not important for identification. The child obtains a broad general impression of the object as a whole, but pays little attention to the specific qualities of particular objects. Neither does he notice these qualities, shape, colour, size, weight, in themselves, as apart from the objects to which they belong. The purpose of Montessori teaching was to encourage children to abstract such qualities and scale them in order. With specially prepared material, in which only one quality varies at a time, this is easier for the child than it is with ordinary objects which, as we have noted, the child regards mainly from the point of view of general appearance and use. We shall see later that these processes of abstraction and generalization constitute a real difficulty for the child when he begins to be taught formal school subjects.

When he first comes to school, the child needs to discover the nature and identity of the features of his new environment. He wants to know what things are, how and why events happen. Thus, he requires explanation rather than instruction. Still more, perhaps, he needs the opportunity, as he did in infancy, to work things out for himself by exploration, experimentation, manipulation and construction. Susan Isaacs, in her book *Intellectual Growth in Young Children* (1930), gives numerous descriptions of the experimental play carried out by the children at the Malting House School at Cambridge, with sand, water, building blocks, water pipes, gas burners, etc.; and how they weighed, measured, melted things, dissolved them in water, and so on. These experiments, the discussions of them and the explanations given by the teachers, enabled the children to

learn and understand much about the nature of materials and the causes of physical phenomena. Their natural intense interest in how and why was furthered; and their powers of reasoning developed and were reinforced.

III. Development of Visual Perception

We see, then, that the primary need of children is to learn to understand and deal with " real " things and events. There is considerable evidence to show that it is some while before they have any desire or capacity to perceive things which may be educationally important, such as details of shape, pattern, arrangement and number. It is true that children can learn at the age of two years or even younger to pick out a simple shape, such as a square, a circle and a triangle, from among others if their choice is rewarded by a piece of chocolate (Gellerman, 1933). And by four years a child of average intelligence can match eight out of the ten outline shapes used in one of the Terman-Merrill test items (Terman and Merrill, 1937). But it is more doubtful if they can remember these shapes. Piaget and Inhelder (1956) showed that a circle and a square could not be copied correctly before about four years of age, a triangle before about five and a diamond before six. With complicated shapes made up of several parts or containing interior detail, accurate perception is slower to develop. This is perhaps best illustrated by Gesell and Ames (1946) in the reproductions made by children of various ages of a figure like a Union Jack (see Fig. 1). Similar mistakes in the reproduction of complex forms have been noted by Meili (1931), Bender (1938) and Piaget and Inhelder (1956). They all indicate that children under six or seven years do not grasp the relationship between the parts of a complex figure. They may perceive the outline, or some of the parts separately, but not the manner in which these are fitted together. The ability to do this may depend as much upon the understanding of relationships as upon immediate perception of shape. Thus, when children begin to learn to read, they may notice the length of a word, and certain letters in it. But they may not perceive or remember correctly the exact shapes of any letter, nor all the letters in the word, nor the relationship or order in which the letters occur.

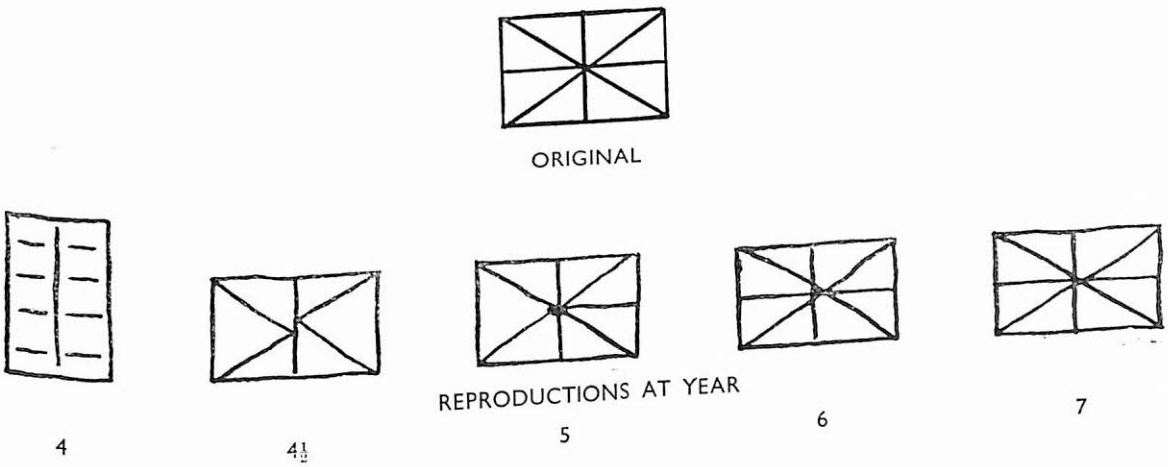

Fig. 1

There is another difficulty frequently encountered in teaching children to perceive accurately, namely, that they tend to see things as part of a total situation from which they cannot be isolated. An instance of this is given by Piaget (1955) of a child of 1½ years who used the name " papa " only for her father sitting in his study; when she saw him elsewhere she did not associate this name with him. In older children this phenomenon appears in an inability to differentiate shapes from their background, and to perceive shape as such independently of its surroundings. Thus, children are particularly susceptible to visual illusions such as that shown in Fig. 2, in which the capacity to perceive that the two horizontal lines are of equal length depends upon isolating them from the attached arrowheads (Walters, 1942). Piaget (1960) has also made a large number of studies of children's perceptions of visual illusions and concluded that they do not know how to direct attention towards the significant features of the figures and ignore the less relevant. If the children's eye movements are recorded, it is found that the eyes of the younger children wander about all over the figures; whereas those of older children concentrate on particular points of importance.

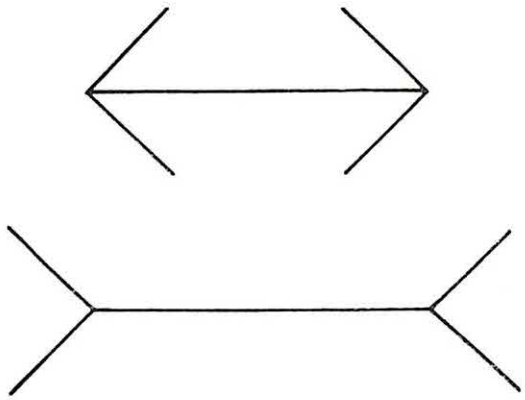

Fig. 2

That children find difficulty in analysing complex shapes and picking out certain parts of them is also shown by their reactions to figures of the type designed by Gottschaldt (1926). He presented a number of simple figures until they were thoroughly familiar. Afterwards he showed complex figures each of which contained one of the simpler ones embedded in it, and found that adults had great difficulty in perceiving the simple figures embedded in the complex ones. Ghent (1956) presented a simple and a complex figure together (such as those shown in Fig. 3) and asked children to trace out the simple figure in the complex one. No children could do this before six years, and many not even at eight years. But Witkin (1960) has recently brought evidence to show that the ability to re-structure what is presented by analysing it and extracting particular parts is a function not only of age and intelligence, but also of certain qualities of personality. He considers that children who are in themselves self-reliant and able to act on their own initiative are more capable of such tasks than are children who tend to relay passively on external circumstances or depend on others.

Fig. 3

There is evidence to show that the ability to perceive shape in general more accurately is not greatly improved by giving practice in perceiving particular shapes. Nor is the ability to perceive letters and words in reading much affected. Thus, Goins (1958) gave six-year-old children extensive training in perceiving figures and numbers exposed for a short period of time only. They became more skilful in perceiving this particular material; but their achievement in reading improved no more than did that of similar children who were given no such training. Again, as Gates (1922) and Kendall (1948) have shown, there appears to be little or no relationship between ability to perceive shapes correctly and to learn to read. This at first sight seems surprising. We can only suppose that by the time children are sufficiently mature to learn to read, they have developed an ability to perceive shapes visually which is adequate for the purpose of reading; whereas less mature children do not improve sufficiently in perception as the result of special training for there to be any effect on their reading capacities.

There is another form of perceptual ability which may be of considerable indirect importance in learning to read, namely, the perception and understanding of pictures. These also seem to depend to a considerable extent on maturation, though naturally they do not develop unless the children are given some experience with pictures. Binet (1908) pointed out that this understanding developed only gradually; and his observations have been confirmed by later experiments (Vernon, 1940). Up to the age of 4-5 years, children, though they can identify familiar objects in pictures, will enumerate them one after the other but will not relate them together in any way. At about 6-7 years they will begin to give simple descriptions of the pictures; but it is not until they are 10-11 years that they can " interpret " what is happening, what the people are doing, and so on. Thus, children of 11 years are supposed to be able to interpret the picture in the Terman-Merrill test (1937) of the telegraph boy whose bicycle has broken down and who is signalling to a car to stop and give him a lift. Naturally, the age of interpretation varies somewhat with the obviousness and familiarity of the incidents depicted. But before they are able to interpret, children may not even pick out the salient features of the picture or the principal actors in the scene depicted, but may notice instead comparatively irrelevant features. Thus, in a picture used by the author (Vernon, 1940) of a man stopping a runaway horse and cart, the man himself was sometimes omitted from their descriptions,

but people looking on were included. This behaviour of course parallels that which appears in children's perceptions of complex forms. The inability to extract the significant features of pictures may be of some importance if children are taught to read words describing the actions of people shown in pictures.

IV. Language Development

We have already noted that in their early language development children learn first to express their wishes and then to name objects and ask questions about them. At first, the phonetic pattern of children's speech is so unlike that of adults that few except their mothers are able to understand them. But Morley and Court (1957) stated that among a sample of over 100 children they tested, about 70 per cent. were intelligible to strangers by the age of two years, though they tended to relapse into unintelligibility when they were excited or upset. Sheridan (1948), however, found that the phonetic pattern of speech of five-year-old children was frequently defective and sometimes so much so as to make their speech unintelligible outside their families. Therefore, when they first come to school such children must have considerable difficulty in making themselves understood.

Children's speech also differs grammatically and syntactically from that of adults. Towards the end of the second year they speak in short 2-3 word sentences consisting mainly of nouns and verbs, prepositions and conjunctions being omitted (McCarthy, 1930). Sentences increase in length from about 4 words each at 3 years to $7\frac{1}{2}$ words at 8 years, according to Templin (1957). Grammatical errors, at first frequent, decrease in number; sentences become more complex in structure and subordinate clauses begin to appear.

It is generally agreed that children understand speech before they speak themselves. Even in early infancy children can often understand and respond to the emotions of adults speaking to them; they comprehend the intonational pattern of adult speech, which reflects the emotions of the speaker, before the phonetic pattern. Then also the adult helps the child to understand words by gesturing, pointing to objects named, and so on. It is difficult to judge how soon and to what extent children hear the phonetic patterns of single words and understand their meanings. Watts (1944) estimated that about 2,000 words were understood at 5 years, and 4,000-5,000 at 7 years. Templin (1957), however, estimated 8,500 at 6 years. These estimates vary with the manner in which they are calculated. They also presuppose that the children hear the words sufficiently clearly to understand them. Yet Midgeley (1952) found that a fair number of six-year-old children failed to hear correctly single words spoken by the teacher, such as " mouse," " rose," " spoon," etc.

The speech and understanding of children clearly varies greatly according to the manner in which they have been brought up. Those whose parents themselves speak well, and frequently talk to their children, will learn much faster than those brought up by parents with phonetically and grammatically incorrect speech and limited vocabulary. Several studies have shown that in middle-class children both articulation and language

structure are more advanced than in working-class children (McCarthy, 1930; Davis, 1937); and, indeed, the differences may increase as the children's ages increase. Bernstein (1958) has put forward the thesis that children in working class homes grow up to speak and understand mainly what may be called " public language ": short, crude and obvious statements about immediate feelings, wishes and actions. Middle-class children, especially those from educated homes, become accustomed to hearing " formal language ": more complex and more logical language conveying the finer shades of meaning and expressing feelings and wishes more subtly and indirectly. So also objects are not taken simply at their face value, but become a point of departure for enquiry and for interpretation of more recondite meaning and significance. These constitute the language and outlook of the school. Not surprisingly, therefore, the middle-class child is more ready than the working class child to accept and profit by his school education. In fact, the latter may resent and react against school teaching. In support of this thesis Bernstein found that working-class boys aged 15-18 of normal intelligence often gave subnormal performances on a vocabulary test; and, indeed, the higher the non-verbal I.Q., the greater the difference between it and the vocabulary test score. Although these were older children, the same type of difficulty and the same discrepancy may well appear in younger children.

But also close personal contact with adults is immensely important in speech development. Kellmer Pringle (1960) found that children brought up in institutions, without close personal contacts with adults, were particularly backward in their ability to understand and to express themselves in speech. Their linguistic development was slower than their intellectual development. Speech develops slowly in children who are mainly in contact with other children. McCarthy (1930) found that children who associated mainly with adults were more advanced than those who associated chiefly with other children; and Davis (1937) showed that in only children speech was more advanced than in others. Retardation may be particularly marked in twins (Davis, 1937). The Russian psychologists, Luria and Yudovich (1959), described a pair of identical twins, aged 5 years, whose mother was retarded in speech, and who, when they first came to school, were so inarticulate as to be incapable of playing with the other children. But they could communicate with each other by noises and gestures. It is often alleged that the children of over-indulgent parents are liable to be backward in speech, because the parents give them everything they want without requiring them to ask for it intelligibly. We do not know if such children are equally backward in understanding speech; but since speaking and understanding speech are closely related to each other in childhood, it seems possible that they are.

Thus, we see that unless in early childhood they have been helped and encouraged by adults to speak and understand clearly, children have little capacity for, or interest in, listening to what the teacher says. Neither can they express their ideas or talk conversationally.

But in order to learn to read children must not only be able to hear and understand words spoken to them, the meaning of which can be understood from the context of the sentence in which they occur. The child must also hear the exact phonetic pattern of the word, and, indeed, be able to analyse this into its constituent sounds, the sounds of the letters or letter groups. Such a process of analysis is probably even more difficult than the

analysis of the printed word shape into its constituent letter shapes. Many years ago a German psychologist, von Ehrenfels (1890), pointed out that a sound pattern such as a tune possessed " Gestaltqualität " (form quality). It was heard as a whole; and the listener was hardly aware of the individual notes apart from their relationship to one another in the tune. Speech also possesses " Gestaltqualität." The child hears sentences as wholes conveying instructions or statements. He is not clearly aware of the words as isolated and independent entities. Still less is he aware of the particular letter sounds within the word. Yet before he can read properly he must be able first to isolate the letter sounds from the word sound, and then associate the independent letter sounds with their shapes in the printed word. Unfortunately, in the English language the vowels have many different sounds, and the child may be unable to tell which is the correct one until he has sounded the whole word. Furthermore, the child may be accustomed to hear and speak vowel sounds with a local accent which distorts them until they are quite unlike those of the teacher.

V. Development of Number Concepts

It appears, therefore, that in many of the school tasks which confront the child he cannot go far as long as he is limited to the use of his spontaneous perceptions. He must use his intelligence to refine these and improve their accuracy. And he must learn to break up what is immediately perceived, to analyse it into its constituent parts and use these independently of the whole pattern of sight or sound in which they are presented.

The ability to analyse and abstract particular features from what is perceived is particularly important in beginning number work. Piaget (1952) has made a number of studies which demonstrate the inability of children below the age of five or six to understand the abstract notions of number, quantity and volume. Thus, if they are shown a number of blocks scattered over a wide area, they say that there are more of these than when the blocks are placed close together. Again, if they are shown water in a wide-necked vessel which is then poured into a narrow-necked vessel, they say that there is now more water than before, because it rises higher in the neck of the vessel. They cannot conceive of the number or volume remaining constant, whatever the manner in which objects or substances are distributed; and do not realize that these are qualities which are independent of the objects or substances quantified and the setting in which they are placed.

In a recent pamphlet Nathan Isaacs (1960) has described some of Piaget's observations of children's concepts of number and quantity, and has pointed out how impossible it is for children to do number work satisfactorily until they really understand that number is an abstract quality, independent of the particular objects numbered. If the children are taught number work before they are quite clear about this, names of numbers and computation processes become a kind of verbal ritual which they learn by heart without understanding in the least what it means. Fortunately, many children seem to acquire this understanding spontaneously as their powers of reasoning mature. But others may require prolonged exercises in estimating numbers of objects in different settings.

VI. Conclusions

We may conclude that both in vision and in hearing perceptual development is active rather than passive. The child does not rest content with a passive reception of the information from the outside world which impinges on his senses. Rather, because of his need to find out, to understand, to get what pleases him, he sets out to explore and to investigate for himself; and to induce adults to give him the objects and the information which he requires. All the time he uses his powers of reasoning to seek knowledge about how, why and wherefore. At first he can reason only by action—by doing things and discovering what happens. But verbal reasoning develops as an accompaniment to such activities. Perceptual and reasoning abilities improve through natural maturation: but they also require the opportunity for exercise, and they require encouragement and help from adults. Children are able to profit from formal teaching in school only when they have reached the necessary stage of maturation, and if and when this teaching appeals to their natural interests.

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TEACHING PROBLEM-SOLVING

by J. D. Williams, *N.F.E.R.*

Introduction

THE problem-solving process has relevance to learning both as a means and as an end: it is involved both in the acquisition of new responses and in their application to new situations. Few educators would deny that this is so, but the extent of this involvement might be made clearer by an examination of the nature of problem-solving, the acquisition of responses, and their application in new situations.

A problem is normally said to arise when progress towards a goal by an obvious route is not possible, and less obvious ways of reaching the goal have to be sought. In this sort of situation, the problem-solving behaviour that results can take many different forms, but it always involves more than the mere reproduction of a learnt response ; the appropriate response may need to be selected from several possible responses, or it may need to be formed by the integration or modification of learnt responses. Say, for example, the child wants the apple that is hanging high in the tree. The obvious means of getting the apple—reaching for it—is out of the question, for the child is not tall enough ; a less obvious means must be sought. The child might think of several ways of dealing with this sort of situation: " Stand on a chair, as I do to get the jam from the shelf—not high enough; throw something at it, as I do to get conkers—might hit the glasshouse ; lassoo it, as they would in a film—branches would get in the way; use the long handle of my fishing net—ah yes!" Thus, from several likely responses, themselves chosen from a wide range of possible responses, the child *selects* an appropriate one. In this case, the child must do more than merely select—he must modify a previously-learnt response, for, hitherto, the fishing net has been used only for reaching for fish, and now it must be used for knocking down apples. Suppose, now, the fishing net handle proved to be too short, after all. The child might think of using the net while standing on the chair. In this case, he would have *integrated* two responses in order to solve the problem.

Problem-solving behaviour of this sort occurs more generally in the learning situation than might be thought. Consider the acquisition of a new response. Sometimes, in this process, problem-solving is very evidently involved, as when the response in question is a problem-solving technique that is acquired by solving an actual problem. But sometimes the problem-solving is not so noticeable as this: even in what might appear to be rote learning a certain amount of problem-solving is likely to take place; the pupil will seek underlying unities and relationships in the material he is learning in much the same way as he would seek the solution to a problem.

Suppose that the pupil were learning his nine times table—an operation that might often be described as " memorising." He might have trouble in learning nine times eight. This would constitute a problem for him. Quite commonly, this sort of problem is solved by an integration of other knowledge about the multiplication tables : " I know that ten eights are eighty, and that nine eights will be one eight less than this." In " memorising " a great deal of search for similarities, differences and other relationships between the present situation and past ones, and between the different components of

the present situation is likely to take place; essentially, this sort of search is problem-solving, these relationships the solutions. All the time, during learning, categories and relationships are being selected, modified or created in order to give meaning to the learning situation. Unfortunately, the person who might well be least of all likely to notice the problematical nature of the learning situation, is the teacher himself. He, of all people, is likely to be familiar with the responses he is trying to get his pupils to acquire, and for him, the components of the learning situation will no longer need to be organised and interrelated. Even " problem mathematics " will tend to become a set of automatic exercises for him; it can only be hoped that he can remain, while teaching, fully conscious of the difference between the automatic way in which he can go through a series of well-practised operations, and the searching, re-organising and interrelating that his pupils will need to engage in before these operations will mean anything to them.

It is held by some that explicit problem-solving, of the sort that is employed in the teaching of mathematics and science, should be made to play an even greater part in learning. These recommend the " problem-solving approach " to the teaching of not only mathematics and science, but other subjects also. We shall examine evidence bearing on the effectiveness of this approach later on.

Consider now the *application* of learnt responses. The form in which a response is learnt is seldom the form in which it will subsequently be used. Even if the response *is* used in roughly the same form as that in which it is learnt, its relevance to a new situation will need to be seen, for no two situations are quite the same. Thus, selection and modification of responses is necessary not only in those activities that most conspicuously involve problem-solving, but in all sorts of applications of responses to new situations.

To illustrate this, we could take a fairly simple sort of response : a newly-learnt word. Perhaps it has been learnt merely in the sense that it has been equated with its definition, or perhaps some of its uses in various contexts have been seen. In the former case none, and in the latter, by no means *all* of its possible uses will have been specifically learnt ; in both cases the pupil will be faced with the problems of adapting its meaning to new uses and selecting the word, when it is needed, from the total of his vocabulary. Where the situation in which the word is required is similar to that in which it has been learnt, there will not be much of a problem. Where the two situations differ appreciably, however, a certain amount of problem-solving will be necessary before the word can be applied. So thin, it seems, is the line between what is usually considered to be problem-solving, and other applications of learnt responses, that one might even go so far as to say that a problem has been solved every time a way has been found of applying a learnt response.

This way of looking at the application of learning has important implications for the teacher, for, as we shall see later, the sort of teaching that leads to the quickest acquisition of responses is not necessarily the same as that which will conduce to the problem-solving activities that are involved in applying these responses. In considering some of the factors that influence problem-solving we might well arrive at some indication of how, in teaching, to increase the likelihood that what is learnt can later be used.

But the relevance of problem-solving to teaching consists not *solely* in the fact that it enters into learning and its application. The ability to solve problems could be regarded as highly important in its own right. In fact, if one were asked to justify the teaching

of mathematics and science to children who were never going to use them in later life, one might well point out that they provide practice in problem-solving. It would be difficult to question the usefulness in adult life of the ability to solve problems.

In this article an attempt will be made to acquaint teachers with research findings relevant to the teaching of problem-solving. Some of these findings derive from situations very close to those in which teaching is normally carried out, but this cannot be said of all of them. Many are derived from experiments upon adults instead of children, laboratory experiments, experiments using problems extremely unlike those to be found in the classroom; for example, in the usual experimental problem only relevant data are given, and there is only one correct solution, whereas in real-life problems it is usually necessary to discard much redundant data before the problem can even be formulated, and there is seldom a *single* correct solution. But by means of such " artificial " experiments it has often been possible to isolate and examine factors that would have been obscured in the classroom.

It is not expected that teachers will be able to see direct applications for all of these findings, but much that psychological research has to offer the teacher is not *directly* applicable to any of the many complex classroom situations that he has to face. Some of these findings can be said to constitute rules of action: they point directly to ways of improving teaching methods; others should be regarded as rules not of action but of interpretation: in the light of these the teacher should be able to follow the problem-solving activities of his pupils more insightfully and to work out for himself how to improve his teaching methods.

Plan

Three determinants of success in solving problems will be considered:

1) Factors in the problem-solving situation.
2) Factors in the problem-solver's previous training.
3) Characteristics of the problem-solver.

Studies bearing on these will be examined, and an attempt will be made to indicate their relevance to teaching.

In addition to this, the advisability of " The Problem-Solving Approach" to teaching in general will be considered.

Factors in the Problem-Solving Situation

With an understanding of the factors that facilitate problem-solving the teacher can make it much easier for the pupil to acquire problem-solving techniques. Further, by imparting this understanding to the pupil he can help the pupil to direct his own problem-solving activities in a more efficient manner. The factors examined below: concrete presentation, verbalisation, graphical representation, " brain-storming," group problem-solving and some motivational factors, are by no means the only determinants of ease in problem-solving, but have been selected because we know something about them and their implications for teaching are fairly clear.

Concrete Presentation

It is often assumed that when presented " concretely," or in a " life-like " setting, a problem is easier to solve and its solution is higher in quality than when presented numerically or verbally.

Lorge and others tried to test this assumption. Using adults as subjects, they posed the problem of formulating a way of getting five men across a mined road. This problem was presented on four different levels of reality: (*a*) verbal description, (*b*) photographic representation, (*c*) as a miniature scale model allowing no manipulation of its parts, and (*d*) as a miniature scale model allowing manipulation of its parts. They found that the quality of the solutions was not affected by the level of reality at which the problem was presented.

In other experimental settings, concrete presentation has been shown to have considerable facilitative effect on problem solving. Gibb found that children were better able to solve three different types of subtraction problem when these were presented concretely, and Long and Welch found that six- to eight-year-olds were better able to generalise a reasoning principle when it was presented concretely.

Thus, seemingly, there is conflicting evidence on the usefulness of presenting problems concretely. However, in interpreting the results of these experiments the following points should be borne in mind:

(1) Slight details of the experimental set-up can make all the difference. For example, one of the advantages of concrete or " real-life " presentations is that more information is available to the solver. In the experiment described above by Lorge and others, subjects working at all levels of reality were given any extra information they asked for, so that this particular advantage of real-life presentation was minimised.

(2) It is perhaps significant that the experiments on children gave positive results. There is much evidence that children's thought is concrete in nature, so it is not surprising that their problem-solving should gain more from concrete presentation.

(3) The advisability of concrete presentation will depend upon the criterion of performance to be used. Although, when the problem is presented concretely, superior solutions are not produced, there may be an advantage in speed. It might be solved more quickly because of the greater familiarity of the terms in which it is presented. Moreover, its solution might lead to greater transfer because of the meaningfulness of the problem-solving activity, or the pupil might find the problem more " interesting " and for *this* reason perform better.

In conclusion it can be said that there are some proven, and several conceivable advantages to presenting problems to children in concrete terms. The usefulness to children of structural and life-like representations of problems might well be underestimated by the adult, who is much more capable of symbolic thinking.

Verbalisation

Although it is by no means *necessary* for the solution of problems, one is not surprised that in some cases verbalisation has been shown to help a great deal.

In an experiment in which subjects were required to discover the correct sequence in which to turn off a set of lights, Ray found that those subjects who were required to formulate their responses before making them solved the problem much sooner. Here, verbalisation helped the subjects to make their responses more explicit, so that they could more easily relate them to one another and to their hypotheses.

Again, Thompson showed that children allowed to verbalise steps in the solution of a mechanical puzzle, solved it in half the time taken by children prevented from verbalising. In this sort of problem it is necessary to make frequent reference to the sequence of the different steps; when they are labelled, their sequence can be reviewed more easily.

There are many different ways in which verbalisation can help in problem-solving. Kurtz and Hovland found that children recognised and recalled objects better after naming than after merely encircling them. Probably it is partly due to this particular advantage of verbalisation that in one experiment young children were found to be much better able to solve a simple multiple-choice problem when names were given to each of the choices. Words are our most effective tool for carrying out a host of operations that are involved in problem-solving. They help us to discriminate, designate, classify, and, by providing a bridge between present problem and past experience, they often enable us to see the relevance of previously-learnt materials and techniques. So that maximum use can be made of this tool pupils should be encouraged to discuss problems as much as possible and even to formulate on paper an analysis of the problem and their plan of attack. The more explicitly a technique of solution is formulated, the more probably will its relevance to a new problem be seen.

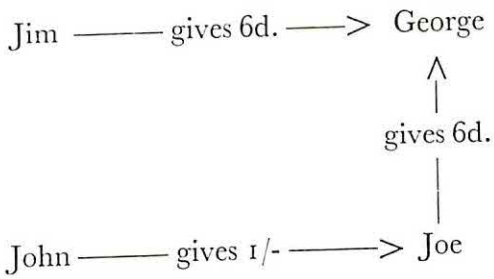
Despite the abundance of evidence in favour of verbalisation there are some experimental situations in which it has proved a handicap rather than a help, so it should not be prescribed indiscriminately. In some cases a clearer and less cumbersome idea of the problem can be framed in spatial terms. Again, some individuals find it easier to think without verbal formulation. In particular, it must be remembered, as was pointed out in the previous section, that children are much less capable of symbolic thought than adults, and they might well be able to engage in problem-solving processes on a concrete level without being able to translate these processes into an adequate verbal form.

Graphical Representation

Verbalising is not the only way of making a problem more explicit or easier to grasp. Sometimes the problem lends itself to *graphical* depiction. Katona, in his "Organising and Memorising," suggests the use of diagrams to encourage relational thinking in mathematics. In an early study of the subject Clark and Vincent showed that graphical accompanied by verbal analysis of problems was a great help. Euler's diagrams too are a classical method for simplifying problems involving class-inclusion.

Interrelationships between key items can be depicted simply and helpfully by graphical means. The following problem provides an example:

" John gave Joe twice as much as Jim gave George. Joe gave George half of what he received. If Jim gave George 6d., how much did George receive altogether?" This becomes much easier to understand when the interrelationships are presented graphically :



In the diagram it is quite evident that George receives 1/-.

As with verbalising, though, this device has its limitations, and there is experimental evidence that it is not helpful in *every* type of problem.

Brainstorming

A. F. Osborn, in his book "Applied Imagination", suggests that creativity in problem-solving is increased by separating the process of *forming* hypotheses from that of *evaluating* them. In this way, one's habitual modes of thought are less likely to determine which hypotheses one produces and less likely to preclude the production of unusual ones.

Meadow and Parnes have put this suggestion to experimental test, and shown that more hypotheses of better quality are produced by :

(*a*) subjects who have undergone a course of training based on this suggestion ;

(*b*) subjects told to produce hypotheses irrespective of their quality, as opposed to those who are told to produce only good hypotheses.

They also found that subjects who have had practice in brainstorming benefit more than others from instructions to produce hypotheses irrespective of quality.

These results indicate that the teacher can over-emphasise the importance of critical thinking. Naturally, it is important that pupils should learn to subject their ideas to critical examination, but they should be made aware that a critical frame of mind can very often inhibit the production of an idea at a point in its development at which it is impossible to assess its true value.

Children are given a great deal of training in critical thinking, but could do with much more encouragement to *produce* and *elaborate* ideas. Teachers in all subjects could well set aside time for 'brain-storming' sessions, in which they posed their children a problem and gave complete licence for the production of hypotheses no matter *how* impracticable or bizarre. The hypotheses could be recorded and sorted out later.

Fear of having silly ideas can sometimes cripple the problem-solver. Hypotheses that appear to have no support from his past experience should be welcomed, for problem-solving is to a large extent *un*learning.

Problem-Solving in Groups

Often it is convenient and often it is desirable for children to work together in groups instead of individually. Various aspects of the efficiency of problem-solving by groups have been investigated.

Klugman found that children working in pairs solved more problems than did individuals, but took more time to do so. He attributed this result to the fact that more hypotheses were presented, discussed and rejected by the pairs.

Taylor and Faust found that groups of two and groups of four were superior to individuals in terms of the number of problems solved and the speed of solution, and that the number of failures decreased in proportion to the size of the group. However, the groups of two were by no means *twice* as efficient as individuals, and the groups of four by no means *twice* as efficient as the groups of two.

The group method of solving problems was shown by Lorge and others to have other advantages. The quality of group solutions was shown to be much higher than that of solutions by individuals, and this was attributed to the fact that groups asked more questions and gained more relevant information than did individuals. In another study by the same investigators, it was found that whereas individuals tended to over-estimate the quality of their solutions, groups tended to *under*-estimate that of theirs.

The work of Shaw provides further evidence of the relatively higher standards of self-criticism obtaining in group problem-solving. She found that far more incorrect solutions were rejected by the group.

It has been suggested that group superiority is due merely to the fact that there is a greater chance of a group's *containing* a good problem-solver than of an *individual's being* one. In support of this view, Marquart repeated Shaw's experiment, but instead of comparing the results of a group of three with those of *one* individual, she compared them with those of *three* individuals. She found little difference between groups and individuals.

We can conclude from the above evidence that group problem-solving is at any rate in some ways more efficient than individual problem-solving, and produces solutions of higher quality. It is therefore desirable that pupils should be given the opportunity to develop the technique and habits of mind that are necessary for this sort of activity. This sort of development cannot take place without plenty of practice, of course, but with the complicated inter-actions that can take place between the members of a group, much can go wrong, unless its activity is guided by the teacher, who should make sure that each child willingly accepts his part in the group's activity, contributes to the discussion, keeps to the subject, permits others to voice their views, can bring himself to abide by majority decisions when there is little to be gained by questioning them but will not be afraid of trying to change the course of the group's activity when there is good reason for doing so. Groups should be carefully composed of members who are not too disparate in ability, fluency or dominance.

Working in groups can be recommended not only as an efficient way of getting problems solved, but also as a useful method of improving the problem-solving abilities of the individuals participating. Since their approaches to problems are bound to

differ in many ways, individuals can be expected to learn a great deal from observing one another engaged in the various activities that are involved in solving problems.

Some Motivational Factors

Three motivational variables known to enter into the problem-solving process are : anxiety, frustration and confidence.

In a later section, anxiety is shown to reduce the subject's ability to change his approach to a problem. Anxiety has been found to impair children's performance on complex tasks much more than on simple tasks so it is possible that teachers using anxiety-promoting approaches to the teaching of simple skills will find that these approaches produce good results and will incline to use them in teaching the more complex problem-solving techniques ; here they will find less success. Problem-solving proceeds most efficiently under conditions of minimal anxiety.

In his book on frustration, Maier has shown how this condition can produce just the rigid, stereotyped, non-adaptive behaviour that is antithetical to successful problem-solving. It has been found that frustration reduces fluency in nine-year-olds, that it reduces the constructiveness of children's play, and that it can reduce one's ability to solve problems. It is important, therefore, that teaching should be such as to minimise the sorts of frustration that can so easily arise in the problem-solving situation as a consequence of over-difficult problems for example, or a premature introduction to abstract problems, meaninglessness of terms and lack of a procedure for dealing with an unstructured problem situation.

There is evidence that failure to solve a problem is often due to *fear* of failure. Lack of confidence probably inhibits the exploration of the problem, the production of hypotheses and the persistence of endeavour that are so necessary in the initial stages of problem-solving. On the other hand, it appears that one *can* be *over*-confident. It has been found that confidence correlates with the length of time wasted in unsuccessful attempts at solving problems. Thus, confidence should be accompanied by enough caution to permit a realistic evaluation of hypotheses.

One very effective way of reducing anxiety, precluding frustration and inspiring confidence, is to make sure that the child is capable of coping with the problems that he is posed. Updegraff and Keister have shown that when, in their training, children have begun on easy problems and progressed through graded stages of difficulty to harder ones, they approach new problems with greater persistence and confidence. The teacher should continually check that the pupil is faced with problems that do not take him far out of his depth.

It is claimed for structural methods of teaching arithmetic that, by presenting the pupil with problems in a way that enables him to cope with them, such methods avoid the development of attitudes and fears which may permanently hamper him in solving arithmetical problems.

Another means of ensuring that the pupil is not disheartened in his first attempts at developing a problem-solving technique is the use of 'crutches'—devices that ease his introduction to a new problem-type and can later be discarded. For instance, in learning

to perform substractions involving carrying, children at first can be encouraged to write down the number they have borrowed and the number remaining in the column from which they have borrowed it, as shown in the example.

$$\begin{array}{r} 7\ {}^{3}\!\not{4}\ {}^{1}2 \\ -\ 4\ 2\ 7 \\ \hline 3\ 0\ 5 \end{array}$$

When they have mastered the technique sufficiently they can solve the problem without doing this. Brownell found that children encouraged to use such crutches understood the process better and computed more accurately. Often, the use of crutches is objected to on the grounds that it establishes habits that have to be unlearnt before the most efficient form of the technique can finally be acquired. In some cases this is a valid objection, but in many, the crutch is automatically short-circuited out of the technique when a sufficient degree of skill has been reached. Any disadvantages there may be attached to the use of crutches, are probably well out-weighed by the advantages of training the pupil upon problems presented in a manner that does not arouse anxiety, that precludes frustration and that establishes a confident approach.

Factors in the Problem-Solver's Previous Training

Now we shall examine eight areas of research in which factors affecting the ease with which problem-solving techniques can be acquired and transferred to new situations have been investigated. These eight areas have dealt with : understanding of essential principles, the use of a variety of training problems, teacher guidance in learning, feedback to the pupil, timing, explicit training in problem-solving approaches, set, and training in creativity.

Understanding essential principles

One would expect that mechanical memorisation of problem-solving techniques would be a far less efficient method of learning them than a method involving understanding of the principles behind them, and there is a vast amount of experimentation to support this expectation. Brownell reports an experiment in which children taught the principle of place value performed the operation of 'borrowing', transferred their knowledge to new problems, and re-learnt it after a period of time, far better than others who had been taught to borrow mechanically.

Others, working with both children and adults have produced evidence that problem-solving techniques are better remembered and transferred when the principles underlying them are understood. In his *Organising and Memorising*, Katona, for example, describes how he taught college students card tricks in two different ways : one group memorised the tricks, while the other was shown the principle behind them. The *memorising* group did not retain the tricks or perform new tricks as well as the other (the *understanding*) group.

But there is evidence that there are conditions under which the 'understanding of principles' policy should be modified. Some investigators find little difference between understanding and memorising methods in their effect on recall or transfer to *simple* tasks, but that understanding is superior in facilitating transfer to *difficult* tasks. Hilgard and others, who were responsible for one of these investigations, point out that where reliance is placed upon understanding, limited understanding can be a source of error. Often, too, the relevance of the taught principles to new problems is less easily appreciated than in the case of the particular transfer situations used above ; there is plenty of evidence from both the psychological laboratory and the classroom that an understanding of underlying principles does not *automatically* ensure the solution of a problem.

Corman, using one of the problems Katona had used in some of his experiments, found that information about *method* of solution produced more solutions and better transfer than did information about *underlying principles*. He also found that abler subjects benefited from additional knowledge of principles more than did less able subjects.

It seems then, that there are limitations to the use of understanding methods. On the whole, understanding methods are to be recommended. They enable particular operations to be unified into general principles, which, because of their greater generality, are more likely to transfer to new problem situations. But :

(*a*) in the case of simple problems, the application of a memorised technique might be easy enough without an understanding of the principles underlying it,

(*b*) the relevance of some principles to new problems might be more difficult to see than that of the appropriate techniques, and

(*c*) less able subjects might be less capable of utilising information about underlying principles.

Training on a Variety of Problems

It is usually assumed by teachers that variety in training-problems facilitates the abstraction of essential principles of solution, thus making easier transfer to other problems. Harlow supports this view, maintaining that variety of training-problems *teaches* the solver how to *learn* to deal with the new problems. Experiments in the laboratory and in the classroom have shown that both adults and children transfer problem-solving techniques better after practising them on a variety of problems.

The principle of variety in training might seem so much in accordance with common sense, and so much supported by every-day teaching experience that it is superfluous to demonstrate and absurd to question it.

However, as in their work on understanding, psychologists have shown that this principle can do with some qualification. Adams found that adults trained on a single sort of problem transferred to a new problem *better* than those trained on a variety of problems. This apparent contradiction was explained by Morrisett and Hovland, who pointed out that increasing the variety of problems decreases the rate of learning to solve any one sort of problem, and that Adams' multiple-problem subjects transferred relatively poorly only because they had mastered their training problems less well.

These investigators showed:

(*a*) that when only a little training was given, subjects transferred better after training on a single sort of problem ;

(*b*) that when a great deal of training was given, subjects transferred better after training on a variety of problems.

In situations where training to a high degree of proficiency is not possible (when the time is short, the problem-solving technique difficult, the pupil dull) it appears that more training on fewer types of problems is indicated. Where training to a high degree of proficiency *is* possible, however, the greater the variety of problems, the better.

Teacher Guidance versus Discovery

There is plenty of experimental evidence that discovering for himself the solution to a problem increases the pupil's ability to transfer his technique of solution to other problems. In one study it was found that pupils who were merely told where they had gone wrong in solving problems learnt and transferred better than those who were told the solutions to the problems in advance. In another, it was found that students could transfer a principle in physics better if they had puzzled over a problem exemplifying it before learning the principle, than if they had learnt the principle before puzzling over the exemplification.

One could expect discovery to encourage transfer, for in seeking the solution to a problem the subject will

(*a*) re-organise the information available in a way that is meaningful to him,

(*b*) deal with the same (problem) situation as he will be faced with in the case of a new problem,

(*c*) learn new ways of solving problems ("learn to learn" as Harlow says).

However, there is also a great deal of evidence that discovery by itself is inferior to teacher-directed ways of solving problems.

In training adults on verbal problems, Craig found that teacher-guidance in the form of directing the subject's attention to underlying principles led to avoidance of more errors while learning, and greater transfer to new problems.

Brownell found that children allowed to solve arithmetical problems without guidance may reach a certain level of proficiency by using an inefficient mode of attack but that they may need to be guided on to a more efficient mode, otherwise satisfaction with some measure of success may prevent the learner from making further progress.

An important variable in experiments on discovery versus guidance is intelligence. In an experimental study of the relationship between intelligence and social atmosphere in group problem-solving, it was found that a permissive, non-prescriptive atmosphere favoured intelligent students, while a traditional, prescriptive atmosphere favoured the less able. However, in another study it was shown that intelligent students were more able to utilise guidance than the less intelligent ones, so it seems that intelligent subjects benefit more under either of these conditions.

Since discovery of a problem-solving technique by the pupil is desirable, but can lead to a great deal of wasted effort and time, and might lead to the development of sub-maximally efficient techniques, a compromise is called for. Such a compromise is provided by what Frandsen describes as "teacher-guidance of pupils' self-discovery experiences". Instead of demonstrating, illustrating, explaining, etc., the teacher guides by questioning, dropping hints, and generally arranging the situation so that the pupil can discover without too much fruitless effort or error the right things for himself. Allowances can be made for the pupil's ability. Brighter pupils will need less guidance but will be able to make better use of the guidance they get.

One can imagine many ways in which the pupil's discoveries could be guided: the teacher could present him with a problem and correct his errors until the technique had been perfected; the technique could be introduced on problems analogous to those to which its application is eventually to be discovered; an analogous technique could first be taught and the pupil could be left to discover the appropriate form of it; hints could be dropped appropriate to the pupil's level of progress, to point the direction his next exploratory move should take; a sequence of prescriptive questions could be asked, the pupil's answers to which would lead him in the direction of the discovery.

A useful illustration of some of these methods has been reported by Thiele. In this case, the pupils needed to learn how to multiply whole numbers by mixed numbers. They already knew that the size of the product was directly related to that of the multiplier, and to bring this back to their notice they were asked to find the products in the examples shown below.

$$6 \times 8 = 48 \qquad 3 \times 8 = 24$$
$$5 \times 8 = 40 \qquad 2 \times 8 = 16$$
$$4 \times 8 = 32 \qquad 1 \times 8 = 8$$

Next, they were asked to look for significant relationships between the products. Eventually they formulated the fact that products diminished as multipliers diminished. After this, $\frac{1}{2} \times 8$ was written below 1×8, and extrapolating from their observations of the behaviour of whole number multiplications, pupils were able to infer that the product would be half of eight. Next, $\frac{1}{4} \times 8$ and $\frac{1}{8} \times 8$ were added on to the column, and pupils were able to work out the products of *these*. In this way they discovered how to find the products of fractions and whole numbers.

Luchins and Luchins provide a further example of this sort. They show how children can be led to discover a generalised procedure for finding the areas of various figures. Dienes has based a structural system of teaching mathematics on this principle and has worked out in detail many applications of it.

Feedback to the Pupil

When faced with a problem, the pupil produces several provisional hypotheses. Unless he can ascertain their appropriateness his progress in solving the problem will be impeded. Likewise, in learning a problem-solving technique, the pupil will need to be fed back some information concerning its effectiveness in the solving of problems on which

it has been tried. This information the pupil receives concerning the effectiveness of his efforts can be described as " feedback."

There is much experimentation to show that feedback is necessary in the learning of simple skills, but less to show its value in the development of problem-solving techniques. All the same, there is *indirect* experimental evidence of its value. Brownell, in the study mentioned in the previous section, showed that children become habituated to inefficient modes of problem-solving unless continually fed back with information as to their progress. The efficiency of teacher-guided conditions of learning is largely attributable to the opportunities it provides for feedback. This same factor probably accounts for the high quality of the solutions produced by groups in the experiment we considered earlier by Lorge and others; within a group, individuals can check and criticise one another's hypotheses.

Without immediate and informative feedback, children are likely to waste more time pursuing erroneous hypotheses, develop and learn faulty techniques, and, in the case of the multi-stage problems, to make at an earlier stage, errors that invalidate perhaps correctly-performed operations at a later stage.

There are various ways of increasing the immediacy of feedback: early marking of books, self-marking by pupils, development of quick approximation techniques so that pupils can tell at least the *order* of the correct answer, development of self-checking techniques, such as solving the problem in more than one way. One of the advantages of structural methods of teaching arithmetic like those of Dienes and Stern, is that when the sum does not " add up " the children know at once, for the blocks do not fit.

Holland, in discussing ways of teaching long division, suggests a way of making feedback more informative: eight common types of error are listed, and code letters standing for the type of error made are written by the teacher at the side of the pupil's examples in marking.

Three Aspects of Timing

(*a*) Intervals Between Learning Periods. The question of the maximally efficient length of intervals between learning periods is a classical one in the psychology of learning and has been studied extensively in connection with the learning of simple tasks. In a review of several studies in this area, Underwood hypothesised that periods of work on a problem should be close together at the beginning to facilitate discovery, but further apart during the later stages to facilitate fixation. However, attempts to test this hypothesis have produced no clear-cut evidence in favour of it. Probably the length of the rest periods required at the different stages in training on a problem depends on the nature of the problem and the ability of the problem-solver. If problem and solver are such that the problem is solved and explored in the first work period, then subsequent work periods will all be " fixation " rather than " discovery " periods.

(*b*) Pacing. If the pupil determines for himself when he will proceed from one problem, or stage in a problem, to the next, his learning is described as " self-paced." If the point at which he proceeds is not determined by himself, his learning is described as " paced."

Although there is some limited evidence that paced learning of a technique can be more efficient than self-paced learning, it is usually held that for the learning of complicated techniques, self-pacing is the more effective method. Pacing has the advantages of forcing the learner to aim for speed of execution and to schedule his operations more deliberately. However, as we shall see in a later section, hurry in the learning of a technique, tends to discourage flexibility in its application. Again, pacing can lead to over-practice of the initial stages of the technique, and under-practice of the later stages.

Despite this, it is difficult for the teacher to avoid pacing the pupils: only by pacing can they all be taught the same thing at the same time. This class-pacing introduces a further difficulty—it cannot accommodate the variations in speed of learning that exist among members of the class.

If self-paced learning could take place, the pupil's progress would still need to be controlled by the teacher to a great extent, for the pupil could not always be expected to know automatically when he had practised one technique, or stage in a technique, sufficiently to proceed to the next.

We can conclude then, that the teacher needs to pace the pupil's learning to a certain extent, but, in doing so, should as far as possible take into account each individual's readiness to proceed.

(*c*) Steps in Problem-Solving. So that his teaching could be in phase with the pupil's progress in developing a problem-solving technique, the teacher should bear in mind that the pupil might require different treatment at different points in his progress. We have touched on this point in the section on brainstorming. In *The Art of Thought*, Wallas suggested that creative thinking proceeds by four steps: preparation (in which relevant facts are investigated), incubation (in which the thinker may allow the problem to rest), illumination (a sudden insight into the solution), and verification (an evaluation of the solution). Evidence has been produced that some types of creative thinking do follow this pattern.

More recently, Johnson has maintained that only three stages can be distinguished: orientation to the problem, production of relevant material (" search " and " free play " of thought) and evaluation of the solution. Others have offered other analyses of the stages by which problem-solving proceeds.

In view of the great variety of approaches to problems found by investigators who have examined individual differences in problem-solving patterns, it would be unwise to accept any of these schemes as universal, but they do serve the purpose of showing that different types of intellectual operation might be needed at different points in the solution of a problem. Preparation of the problem and evaluation of the solution need to be carried out in a careful, analytical, critical frame of mind, whereas production of hypotheses requires enthusiasm, fluency, and a certain amount of abandon.

As pointed out in the section on " brainstorming," account should be taken of the differences between approaches required at different stages in the solution of a problem.

Explicit Training in Problem-Solving Approaches

There have been many reports of improvement at problem-solving following training in ways of approaching problems.

In some cases there has been success after previous practice of what might be called *abilities*, rather than *approaches*. The solution of many problems, of widely different varieties, depends on the mastering of abstract verbal relationships, and it has been shown the the ability to solve such problems can be improved by training in interpretation and discussion of the printed word, and in logical analysis.

There is some evidence that improvement in problem-solving can result from training in *general approach*. Glaser, for instance, found that of all the aspects of thinking he tried to train, an attitude of *thoughtfulness* was the most susceptible to improvement.

Advice on solving problems has often proved useful. Bloom and Broder compared the problem-solving behaviour of successful and unsuccessful students and devised a checklist which provided an approach to solving problems; they found that training on this checklist improved performance on new problems.

In addition to training in the techniques necessary for solving problems, it is often found necessary to *make explicit* the fact that these techniques can be transferred to other problems. It has often been found that a *readiness* to transfer learnt techniques, produced by instructions during training, makes all the difference to whether or not transfer later occurs.

As an example of the sort of explicit general advice that can help children to tackle problems, here is a routine suggested by Frandsen in "How Children Learn." He suggests that children should proceed, in solving arithmetical problems, by the following eight steps:

(1) Determine what is wanted.

(2) Find which of the given facts are relevant.

(3) State in a single sentence what is wanted as a function of the data given.

(4) Restate this in arithmetical language.

(5) Try to recognise this statement as one of the standard operations used in arithmetic, and plan the solution.

(6) Estimate an answer.

(7) Make necessary computations.

(8) Check the solution. (*a*) Does the answer approximate to the estimated answer? (*b*) Perform any possible arithmetical check.

Explicit training in abilities, attitudes, techniques and procedures appears to be beneficial, and its benefit appears to increase when its relevance to future problems is made clear to the pupil. But in addition to this, the teacher could well help the pupil to understand some of the *processes* at work in problem-solving. Part of the improvement that results from practice in problem-solving is due to increased insight into how best to *manage* one's self in preparing for, and engaging in this activity. There is no reason why this sort of insight should not be taught more directly to older pupils by giving them some sort of an understanding—even if only a rudimentary one—of the psychological laws governing their thinking. Not only in problem-solving, but in many other areas it should be possible to improve the pupil's learning and performance by direct instruction in how to analyse and to some extent manipulate one's own thinking.

The Effect of Set

Failure to solve a problem cannot always be attributed to lack of intelligence, knowledge or motivation. Often, the problem-solver fails because he is " barking up the wrong tree," or, in other words, has an inappropriate " set " that he cannot change.

Sometimes this inappropriate set has actually been implanted by the training the problem-solver has received. Having learnt to solve certain problems using a particular technique, he tries to use this technique on other, similar problems to which it is inappropriate. Many of the studies of this " method-set " have involved training the subject on a series of problems requiring the use of a certain technique, then testing him either on problems that permit but do not necessitate the use of a different technique, or on problems that cannot be solved without changing to a different technique ; his disinclination or inability to change from an established technique to a more appropriate one is taken as a measure of what can be called " problem-solving rigidity."

Many factors in the learning situation have been found to contribute to the development of problem-solving rigidity. Naturally, these will interest the teacher, whose objective will be to teach problem-solving techniques in such a way as to minimise the likelihood of their being applied rigidly. Here are some determinants of rigidity:

(*a*) Amount of training. Generally, it has been found that the set to use a particular technique rigidly, and despite its inappropriateness, increases with the amount of training on it. This is what one might expect: there are many situations in everyday life in which one becomes habituated to a certain way of doing things and as a result becomes less attentive and tends " mechanically," " automatically," " without thinking " to carry on in this way even when circumstances have changed. There is some evidence, though, that this mechanisation increases with practice only up to a point. One investigation indicates that beyond this point mechanisation might even be reduced. Perhaps when a technique has become very familiar the subject begins to try out alternative approaches—or perhaps he gains enough insight into the principles underlying it to see the limitations of its applicability.

Since the effect of practice is by no means *always* to increase rigidity, and since practice is desirable for various reasons, we shall consider removing not practice but certain rigidity-producing conditions under which it can take place.

(*b*) Distribution of Training. It is found that rigidity in application of a problem-solving technique is reduced when training in it is interspersed with rest periods.

(*c*) Speed. Rigidity is reduced by enforcing a pause between the presentation of training problems and their solution, and increased by instructing the subject to hurry through the training problems. In order to speed, the subject has to reduce his attentiveness to problem-requirements and mechanise the technique as much as possible.

Teachers often encourage speed when training their pupils—it is often used as a criterion of success. It certainly *does* indicate a *sort* of mastery of a problem-solving technique, but conduces to mechanisation and thus reduces the pupil's ability

to modify the technique when faced with a somewhat different problem situation. A more leisurely learning of the technique allows the pupil to explore more aspects of it and encourages him to retain a greater attentiveness to features of the problem relevant to its applicability.

(*d*) School Atmosphere. Luchins, who was to a large degree responsible for the interest that has been taken in this aspect of problem-solving, noticed that children from permissive and active schools were less handicapped by the development of a rigid method-set than were children from schools with a more authoritarian atmosphere. Whatever the merits of authoritarian teaching, it does not seem to be the best sort of preparation for problem-solving in a variety of situations.

(*e*) Anxiety. Subjects scoring high on the Taylor Manifest Anxiety scale have been found to be more rigid than others, and less able to shift from a set technique in response to new problem-requirements. Likewise normal subjects become more rigid when made to feel anxious or too ego-involved in the problem-solving activity. Thus, there are some sorts of motivation that are likely to reduce the pupil's flexibility. The teacher can avoid these by encouraging interest in the problem-solving activity for its own sake instead of relying upon extrinsic motives such as fear of failure or the wish to impress.

(*f*) Similarity of Training Problems. It was concluded in a previous section that training on a variety of problems usually leads to greater transfer of the technique. There is experimental evidence that it also results in a reduction in rigidity of the application of the technique. Perhaps this is because such varied training sustains attentiveness or perhaps it is because it encourages the development of a variety of alternative sets. Whatever the reason, it seems advisable in training to embody the technique in as many different types of example as possible (bearing in mind the reservations made previously, of course).

(*g*) It has been shown that exposure to unsolvable problems during training increases rigidity. This underlines the necessity, pointed out previously, for care in aligning difficulty of training problems with the pupil's ability and skill.

The set to use a particular problem-solving technique is not the only sort of set that can hamper the problem-solver. He may interpret the problem-requirements in a misleading way and be unable to abandon this interpretation for another. Again, he may have to abandon a set idea of the function of certain materials or techniques before he can see their relevance to the problem.

The teacher can go a long way towards countering these interfering sets by training the pupil to keep an open mind when faced with a problem, to look at it from as many different angles as possible, to explore it freely and avoid repeating approaches that have failed. It should be clear that the sort of frame of mind established in " brainstorming " is likely to reduce interference due to set.

Training Creativity

A great deal of teaching is aimed at getting children to make responses that conform to adult standards. In problem-solving, however, responses of an original sort are often

needed, and the child often has to break away from taught patterns of behaviour in order to make them. In fact, as shown in the section before this, established patterns of behaviour often impede the production of an original solution.

Recently the possibility of training subjects to produce original responses has been investigated by Maltzman and others. They have worked on the assumption that obvious, commonplace responses will be " high in the response hierarchy " (uppermost in the mind) and that original, unusual responses will be " low in the response hierarchy " (at the back of the mind). They found that they could get subjects into the habit of producing responses " low in the response hierarchy " by requiring them to give repeatedly different associations to certain words. After training of this sort, subjects produced significantly more original associations to other words, and performed better on a test of originality.

This is only a beginning in the exploration of this important field, but it does suggest that pupils would benefit by being more often encouraged to give unusual, " off-beat " responses rather than those that are most likely to be in line with accepted adult standards.

Characteristics of the Problem-Solver

Characteristics of the problem-solver are much less amenable to control than are variables in training and the problem situation. However, it is important that the teacher should be alert to them, so that he can make appropriate allowances in his handling of other factors in this situation.

In this section, individual differences in approach will first be considered, and then differences in performance due to age, sex, ability and personality.

Individual Differences in Approach to Problems

Any attempt to understand and control the process of problem-solving must make allowance for the great differences that obtain between different individuals' behaviour in the problem situation. After observing over 500 subjects working on a variety of mathematical problems, Buswell concluded that individual differences in approach were so great that no precise recipe could be given for successful problem-solving.

Different investigators have classified differences in approach in different ways. Durkin found that three main types of attack were used: (*i*) trial and error, (*ii*) insight, and (*iii*) gradual analysis of the problem. She believed that these were not qualitatively different from one another or mutually exclusive. She observed that subjects often switch from one to another during the course of solving a problem.

Guest found that three different types of thinking were distinguishable : (*i*) superficial, illogical, (*ii*) concrete-specific, (*iii*) analytic-deductive.

Again, Chant distinguished between *these* different types of problem solving activity: (*i*) interpretative behaviour based upon the solver's established associations; (*ii*) analytical behaviour, emphasising comparisons of the stimulus materials.

It appears then, that an individual's approach to the problem situation can vary along many different dimensions. Taking with this the fact that problems themselves

also vary widely, it is not surprising that great care has to be taken in advocating particular problem-solving procedures.

Age

Although there are many obvious differences between the child and the adult in problem-solving, the experimental evidence supports Anderson's claims that " from early childhood to adult life, essentially the same mechanisms of problem-solving are found."

Heidbreider and Hazlitt both found what they called reasoning in children less than three years of age, but the reasoning was confined to concrete, personal and immediate situations. Hazlitt attributed Piaget's emphasis of the difference between adult and childish thinking to an over-valuation of verbal expression as a measure of thinking, and an exaggerated view of the logicality of adult thought.

Studies aimed at ascertaining whether pre-school children show insightful problem-solving indicate that a great deal of trial and error takes place before the solution is obtained. This does not mean to say that pre-school children are *incapable* of insightful solution of problems. On the contrary, there is a great deal of evidence of insight at this age. When the problem is such that the child has in his repertoire ways of interpreting and attacking it, he is much less likely to resort to trial and error; even adults will proceed by trial and error when there are no leads as to how else to proceed. So, if one hopes for insightful problem-solving from young children, one must take care to present them with problems that are intelligible to them.

In an earlier section some of the advantages of concrete presentation were indicated. Whereas adults often find concrete presentation of a problem helpful, to children it is usually very *necessary*. Children have much less capacity for ideation and symbolic thought than adults, but can cope with quite difficult problems if these are embodied in concrete form and can be solved by manipulating not symbols, but objects.

Thus, although children undoubtedly have less problem-solving ability than adults, it is easy to over-estimate differences in other respects. Children do not *inevitably* tackle problems by trial and error, but, because they are unable to interpret a problem, because they have not been shown how to deal with certain sorts of problems, or because the process of systematically solving the problem requires powers of symbolic thought that they do not possess, they are often forced to resort to this strategy. By presenting them with problems in concrete form, and in such a way that the solutions can be reached by the manipulation of objects, teachers can encourage even the youngest of their pupils to engage in the goal-directed, insightful activity that leads to a much greater understanding and will provide a foundation for the sort of problem-solving they will need to do in later life.

Sex

Many sex differences have been reported in the area of problem-solving, but often the differences have been discovered in experiments that have been mainly concerned with some other aspect of this activity; consequently we have only a fragmetary account of how the sexes compare. In general, though, it can be said that males have been found to be superior to females.

In some studies a comparison between the two academic activities of acquiring information and solving problems has been made. Bedell, for instance, found little difference between boys' ability and girls' ability to acquire science information by reading a passage, but found that boys were significantly superior in solving a problem that required them to draw information from the passage. Likewise, Billings found that the sexes were equally able to acquire information in eight different academic fields but that men were significantly better at solving problems in these fields. These findings are very much in accordance with the sort of distribution of abilities that one expects to find in the classroom. Girls are usually expected to be bad at maths—a subject in which much problem-solving is required—and, if they are good at some branch of science it is expected that this branch will be botany or zoology, which involve less problem-solving than other branches. On the other hand, in subjects like geography, history, etc., that involve less problem-solving and more acquisition of information, one expects to find less difference between the sexes.

But not *all* investigations have demonstrated sex differences in problem-solving ability, and one study suggests such differences as have been demonstrated might well be attributed to differences in sex-role identification. It would be interesting to find out which ingredients of the problem-solving process are tied to which aspects of the sex-roles. Perhaps women could be brought up to be better problem-solvers without losing the more indispensable features of their femininity.

Ability

There is evidence that ability to solve problems of one sort accompanies ability to solve problems of other sorts. To account for this, a general reasoning ability has been postulated.

However, considering the complexity of the thought processes that can take place in problem-solving and the variety of possible problem-situations, it is not surprising that problem-solving ability has been found to be analysable into many different components.

Considerable progress has been made in the analysis of problem-solving ability by Guilford and his associates at the University of Southern California. They find that intellectual ability can be divided into memory factors and thinking factors. Thinking factors—which are those that are more involved in problem-solving—consist of three sorts:

(*a*) Cognition factors. These have to do with becoming aware of things—seeing relations, classifying, etc. These are what are involved in *understanding* the problem.

(*b*) Production factors. After the problem has been understood, something has to be done about it. Analogies have to be sought, hypotheses produced. At this stage such abilities as fluency and flexibility come into play.

(*c*) Evaluation factors. The final stage in problem-solving is that in which judgement of the quality or suitability of the solution takes place. Such factors as the ability to make perceptual judgements and to see logical inconsistencies operate at this stage.

Each of these classes of factors can be divided into sub-classes according to the content of the thought process (whether symbolic or behavioural, for example) and its end product (whether in terms of relations or classes, for example).

Dozens of these factors have been identified, and we can assume that many different sorts of abilities operate in problem-solving.

This sort of analysis of ability could have an important relevance to education, for:

(*a*) with a knowledge of the abilities involved the teacher could assess far more accurately his pupil's strong and weak points in problem-solving;

(*b*) this done, the pupil could be given selective training to make good his deficiencies.

Oriented in this way to the essential abilities underlying problem-solving, teaching could be much more economically carried out.

Personality

Like most other kinds of endeavour, problem-solving style and ability are affected by the personality of the individual engaging in it, and some useful leads on how best to deal with a pupil's learning in this area are sometimes suggested by certain personality characteristics. Thus, an impulsive, active, heedless sort of pupil could be expected to do well at the productive stage in problem-solving but less well at the evaluative stage. The persistent could be expected to cope with more difficult problems, the self-confident should be able to tolerate more failures. Rigidity has been much studied as a personality trait, and one can conclude from these studies that the pupil who is respectful and amenable to discipline, and so in some ways ideal, might well be incapable of the flexibility of approach that is necessary in problem-solving. Again, the anxious pupil will probably strive hard and achieve some success in subjects in which acquisition of knowledge is of prior importance, but where originality of response is required, as in problem-solving, the inflexibility of his thought, or his inability to suspend judgement might well prove to be a severe handicap. Another trait that is likely to have an effect on problem-solving ability is individualism.

The individualist will often be much less handicapped by conventional preconceptions than will others, and is more likely to produce unusual hypotheses and to persist in their elaboration. Although not invariably, he will sometimes be a potentially valuable originator. Unfortunately he might be unable or disinclined to make the conforming-responses that are so often interpreted by the teacher as indications of ability.

" The Problem-Solving Approach "

The main part of this article has been concerned with ways of teaching problem-solving techniques. In this section we shall consider the possibilities of using problem-solving as a tool in teaching.

The use of " problems " in the teaching of mathematics and science is, of course, standard practice—although even in these subjects the sort of " problem-solving " that goes on in many classes is a degenerate form, involving the mechanical insightless manip-

ulation of well-worn rules and facts. In other subjects, though, there is less often even a pretence at using the problem-solving approach. There have been several attempts to show that the teaching of many subjects can benefit from this approach.

Cook and Koeninger, for example, found that students using the problem-solving approach in college sociology courses gained as much factual knowledge as other students, and improved much more than others in " attitudinal tendencies " and critical thinking.

Not all researches have favoured this approach so decisively. Quillen and Hanna tried to compare the effectiveness of the chronological, the topical and the problems methods of teaching social studies to high school children. They found only small differences between the three methods. Although pupils using the problems method improved more than others in certain skills and attitudes, the chronological method resulted in the greatest gains in information, and, surprisingly, the greatest improvement in research techniques. The topical approach, incidentally, fared by far the worst.

In a carefully-planned study Kight and Mickelson compared the effect of problem- and subject-centred types of presentation upon learning on the one hand factual information, and on the other, rules of action. They experimented on the teaching of English, science and social studies. In English and science, pupils gained more factual information from problem-centred teaching, but not in social studies. In all subjects pupils learnt more rules of action from a problem-centred presentation. Kight and Mickelson make the following recommendations for users of the problem-solving approach:

(i) The problem should be clearly stated and analysed into its sub-problems.

(ii) As far as possible pupils should be made to see that the problems are their own personal problems.

(iii) *Doing* rather than *knowing* should be emphasised.

(iv) Rules of action necessary for the solution of the problem should be taught clearly and specifically.

(v) A rationale should be given for the rules of action taught.

To these recommendations could be added several that could be drawn from the researches described earlier in this article.

In attempting to assess the value of this approach, one must take into account the fact that it involves many new skills of teaching and learning. It has been observed that gains in its use grow considerably after the teacher has had some years' experience with it, and probably the pupil takes some time to learn how to learn by it. Even so, much of the research on the problem-solving approach indicates that it is superior to traditional approaches in most ways. There is some doubt that it is the most efficient means of inculcating factual information, but merely to do this is less often the teacher's aim, nowadays.

Some Final Points

Achievement and Process Orientations

In the introduction to this article it was pointed out that the results of many of the studies examined would not be *directly* applicable to teaching. One reason for this has

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already been indicated: there are so many different kinds of problem, so many different kinds of problem-solver and so many different kinds of activity involved in solving problems that there are bound to be difficulties in generalising findings from one sort of problem-situation to another. There is another reason though: that the psychologist approaches problem-solving from a different point of view from the teacher. The psychologist is interested in the processess underlying problem-solving and selects for study those aspects of the activity that will enable him to understand it. The teacher, on the other hand, is primarily interested in getting his pupil to attain certain academic ends, and needs information on the best procedures for bringing about this attainment. Since the psychologist is thus *process*-oriented and the teacher *achievement*-oriented, it is not surprising that a certain amount of alignment is needed before the findings of one will be of use to the other.

An alignment from *one* direction has been attempted in this article: an attempt has been made to select findings on problem-solving that are relevant to teaching and to present them in categories that emphasise their implications for teaching procedure. But an alignment from the other direction could be made: teachers could acquaint themselves with the processes underlying problem-solving and become more *process*-oriented in their teaching. Two benefits might accrue from this:

(*a*) With an understanding of the psychological processes involved the teacher would have some means other than that of trial and error by which he could select appropriate teaching procedures, and would be better able to diagnose and remedy faults in these procedures.

(*b*) It can be held that the attainment of particular academic ends is only incidentally important to the development of fundamental abilities and skills that have a much more general usefulness; e.g., in the case of problem-solving, the ability to think logically, to criticise, to produce hypotheses, to abstract the essential features of a situation. If the teacher analysed the teaching situation in terms of these he could encourage their development with much more economy.

Acquisition and Application Orientations

The simplest way of ascertaining whether or not a pupil has learnt to make a response is to get him to try to reproduce it. Where this sort of testing is used, no great allowance needs to be made for differences between the form in which the response is learnt and that in which it is applied. However, where the test involves solving problems—and, as pointed out in the introduction, most tests *do* involve solving problems—the subject has, almost by definition, to do more than simply *reproduce* a learnt response: he might have to modify it, or re-interpret it so that its relevance to the problem becomes clear, or completely re-organise his learnt responses to reproduce a new response. Thus, where learning takes place with a view to solving problems, allowance must be made for the likelihood that the form in which the response will be applied will be different from that in which it is acquired. This sort of learning could be called *application*-oriented, to distinguish it from learning merely to reproduce—which could be described as *acquisition*-

oriented. Most of the suggestions contained in this article have been on how to orientate the learning of problem-solving techniques to their eventual application.

Imparting Self-Guiding Skills to the Pupil

The distinction between acquisition and application orientations is relevant to a point made earlier.

In the case of acquisition-oriented learning, the teacher is present to guide the pupil at the stage that is of most importance in this sort of learning: that at which the responses are acquired. But in the case of application-oriented learning there is an important stage in the process at which the pupil's activities are no longer guided by the teacher: that at which responses are *applied.* Thus, in the case of application-oriented learning, the pupil will have to learn how to guide his own activities. This is why, in this sort of learning, it is particularly important that the pupil should be equipped with some sort of understanding of the psychological laws that operate in the application situation. Given advice based on such factors as are dealt with in the third part of this article, the pupil will be placed in a much better position to apply his training in the solving of problems.

But we should not stop here. Not *all* of the value of teaching is that the pupil learns to make responses and in some cases learns how to apply them in new ways; part of its value is, to use Harlow's phrase, that the pupil " learns to learn." In the course of learning he picks up techniques of learning that help him to learn in other situations. This very important part of the learning process could be supplemented by imparting to the pupil some sort of sophistication about the learning process. Thus, advice to the pupil himself could also be derived from the fourth section in this article.

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Note

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Space does not permit the printing of a full list of the works on which this article is based. Such a list can, however, be obtained separately from the N.F.E.R. Requests should be addressed to the Information Service and accompanied by a 6d. stamp for postage.

CEREBRAL PALSY

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Introduction

DURING the past ten years, the terms " spastic " and " cerebral palsy " have become increasingly familiar to the general public, the majority of whom, until the advent of the 1944 Education Act, had remained unaware of the number of children who were handicapped by one or other of the several syndromes included in the generic term " cerebral palsies of childhood."

One door, in particular, to special educational treatment which formerly had been closed to a large proportion of those with cerebral palsy, was opened wider than before: an important permissive clause making possible an extension of special educational treatment appropriate to the age, ability and aptitude of handicapped children up to the age of nineteen years when considered to be advisable.

Even among educationists and teachers, however (including some with Special school experience) there was still uncertainty, if not actual pessimism, concerning the educability of children more seriously handicapped than those with whom they were already familiar. Children with spastic hemiplegias were often enough to be seen in the existing special schools, both those for physically and mentally handicapped children, but in all cases they were children with a considerable degree of mobility and in general able to take an active part in most of the school activities. There were, however, good reasons for most of the doubts expressed. The cerebral palsies are not " diseases " in the usual sense of that term, but present a variety of combinations of motor disorders, sensory defects, degrees of intellectual impairment and lack of natural function control which, in many of those most severely afflicted, can be not merely socially unacceptable, but may even arouse revulsion in people unfamiliar with the condition. On this account many of the most severely handicapped cerebrally palsied children remained for the most part at home or were in hospitals or institutions.

Although for centuries past most of the numerous varieties of the condition must have occurred, clinical descriptions in medical literature did not appear until little more than a hundred years ago. The most widely known of these are the two papers by Dr. W. J. Little of the London Hospital who, in 1841, described in the *Lancet* " A Condition of Spastic Rigidity in the New Born " and, in 1861, presented to the Obstetrical Society his famous paper based on 200 cases of the condition which he had observed over the twenty years since his earlier paper had been published. Since then, some hundreds of papers and articles have been read and published, both in this country and elsewhere. The greater part of them, however, have appeared only since an impetus was given to more intensive diagnostic and research work after the War. This relatively sudden arousal of interest, occurring such a short time ago in a condition which, of its nature, did not appear to offer much hope of any very effective, let alone curative, treatment, may in

part be attributed to an interest shown by the Ministry of Education. To ensure that, as far as possible, the new Act should extend educational opportunities to all handicapped children who could profit satisfactorily, all types and conditions of defects and deprivations were considered, including the cerebral palsies which had, until then, been thought to present difficulties beyond the scope of most of the existing special schools. In the light of the growing knowledge about these difficulties, the Ministry was obviously prepared to be generous in its interpretation of the Act, which postulates that a child shall be capable of benefitting satisfactorily, and to make due allowance for the fact that the devising and modification of special methods for children whose progress would in most cases be very slow, would require a considerable experimental period.

In this country, it is a tradition that many new services and extensions of existing schemes are first sponsored privately, or by Voluntary Bodies, before Public Authorities are committed by legislation to statutory responsibilities. This affords opportunities to put schemes to practical test, to modify them and even, if necessary, to terminate them, without recourse to acts of parliament. Much of the evidence for or against changes in the law may be drawn from the results of pioneer work by Voluntary Bodies and the benefit of expert advice from the Ministries concerned is usually welcomed by those Bodies undertaking services which may later become the responsibility of government departments. With the passing of the Education Act of 1944, it was clear that the Ministry was already aware of certain omissions in these special education schemes which, until then, had been available for handicapped children and much thought had already been given to the problem of children who, by the nature of their handicap, sometimes appeared to fall outside the scope of the existing schemes. Considerable interest had, for example, been taken in the work of a special Cerebral Palsy Unit at Queen Mary's Hospital at Carshalton, where teachers and other experts had been working together since 1942 to devise and put to trial methods by which many children, who would not have been admitted to any of the then existing special schools, were enabled to make a beginning in the basic subjects, or in those occupations which are introductory to more formal education. The progress and particular difficulties of large numbers of other children, who were already attending special schools, were also carefully considered. The degrees of handicap which these latter suffered were admittedly less severe than were those of the children in hospital schools: hemiplegias and paraplegias predominated; the children were reasonably mobile, within the confines of home and school at least, and usually had controlled use of at least one hand. Nevertheless, it was plain that some of them needed more in the way of special help than most of the existing special schools could afford them.

When, therefore, in 1946, a meeting was convened in London and attended by eminent members of the teaching and medical professions, and by representatives of the education services and other Local Government Bodies, the Ministry of Education sent Assessors from related government departments and actively supported the founding of the British Council for the Welfare of Spastics. The purpose of this Body, whose Council was assisted by Educational and Medical Advisory Committees, was . . . "To act as the central advisory, co-ordinating and consultative Body for all activities within the British Isles directed to the well-being of sufferers from spastic paralysis and its allied conditions."

The objects of the Council were so many and various that it could not have fulfilled its declared aims without the active support of private individuals, as well as of other organizations and professional and public bodies, especially those departments of Local Authorities concerned with education and child welfare. During its fourteen years of existence, the Council has carried out its work steadily, but with no great publicity.

Meantime, groups of parents of cerebrally palsied children and others anxious to promote the opening of special schools in different parts of the country, began to form themselves into local and regional associations which, meeting at first informally to discuss their children's difficulties, exchange ideas about ways of helping each other and their children to cope with the many problems which the handicap introduced and, incidentally, often to afford each other moral support in the face of recurrent disappointments, gradually gathered strength. Ideas, effort, time and money were contributed towards opening and equipping the first Voluntary Special C.P. schools and widespread public appeals were launched for money to start treatment and education centres for children who still would have little hope of entry to those schools at which, the Local Education Authorities being financially responsible for the pupils, they could be admitted only if they gave evidence of capacity to benefit satisfactorily from the types of education offered. Many of the parent associations gradually amalgamated into the National Spastics Society, with funds sufficient both to open schools and centres and to endow medical research into some of the problems which the pathology of cerebral palsy still presents. Although the activities of both the British Council for the Welfare of Spastics and the National Spastics Society undoubtedly gave further impetus to the opening of schools and special units within existing schools, there still remained many practical questions, the most obvious being the sort of special education to be provided and the actual methods to be employed for children with such a multiplicity of handicaps as many of them had.

In order to appreciate why most Local Education Committees' special schools had had to exclude many cerebrally palsied children, it is necessary to understand something of what the condition involves physically, mentally and socially, the extent of the general incidence found among children (especially those of school age), and the proportions of these who have handicaps too severe for any educational schemes of a more formal kind to be of any benefit.

Shortly before the founding of the B.C.W.S. and while the N.S.S. was still in the embryonic stage of rather informal and loosely organized local and regional groups, the Foundation for Educational Research, at that time a department of the London University Institute of Education (later to become an independent body, the National Foundation for Educational Research in England and Wales) was encouraged by the Ministry of Education to sponsor an inquiry into some of the aspects of cerebral palsy which affected the educability of children with this handicap.

In 1946, when this research was initiated, there existed no schools exclusively for cerebrally palsied children, although two such schools were then being planned by voluntary bodies. Much preliminary investigation was needed, however, in order to discover some at least of the main factors which had set limits on the extent to which cerebrally palsied children had been able to profit from the then existing opportunities for education. It was hoped that more information about those limiting factors would

help to point the way to essential modifications of method which undoubtedly would be needed in new establishments which were about to open.

At that time, even estimates of the incidence of cerebrally palsied children in this country were largely matters of guesswork, as was also the question of the proportion of such children likely to prove educable in any useful degree whatever the opportunities offered.

Main Types

The term " cerebral palsy " is an inclusive term covering motor disorders which are sequelae of structural and biochemical abnormalities of the brain. They are usually non-progressive and may occur pre-natally, during the process of birth, neo-natally, or in very early childhood. Classification of the cerebral palsies is difficult, since there seems to be no single cause. For practical purposes, however, they are usually described in terms which refer to the type and distribution of the resultant paralyses and inco-ordinations. Five main types are recognized, each with its peculiar difficulties, and are as follows:

1. *Spasticity.* In this condition, abnormalities of the pyramidal tracts are manifested, among other ways, in characteristic muscle spasm, with a tendency to contractures which produce characteristic postures, such as the bent and pronated forearm. The spastic conditions are further subdivided according to affected site: " monoplegia " being used when one limb only appears affected, " hemiplegia " when both upper and lower limbs on the same side are involved, and " quadriplegia " when all limbs have abnormal movement.

2. *Athetosis.* In this condition the extrapyramidal nervous system is chiefly involved, causing a succession of involuntary writhing movements, particularly in the more distal muscles, whenever voluntary movement is attempted. The involuntary movements are not confined to the limbs, but affect the head, trunk, and respiratory system as well, produce facial grimacing, drooling and disturbances of breathing rhythm which in turn result in peculiar executive speech defects.

3. *Ataxia.* This is another extrapyramidal abnormality and, in the very early stages, difficult sometimes to distinguish from athetosis; it also involves general lack of muscle balance, but does not produce the writhing movements characteristic of the latter condition.

4. *Tremor.* This, as the name implies, manifests itself in generalized, continuous, fine rhythmic movements over the whole body.

5. *Rigidity.* In this condition, voluntary activity is impossible and there is considerable general resistance even to movements passively performed.

These conditions are not necessarily mutually exclusive. Since children with any one of them would present problems in any school, it can well be imagined how, when more complicated involvement is present, the difficulties can seem almost insuperable. In addition, as might be expected, there are frequently accompanying mental abnormalities, which aggravate the difficulties arising from the physical disabilities and play an

important part in setting even closer limits on the educational prospects of many cerebrally palsied children.

While the first causes of many of these conditions are still either unknown, or unclear, and it is not possible to link any one causal factor exclusively with any one of the cerebral palsy types, a good deal is now known about some of the predisposing conditions which are at least contributory.

Causes

That inheritance plays at any rate a small part among other pre-natal factors seems now to be accepted, despite any former doubts. During the past twenty years, at least twenty communications have been published referring to children whose sibs, or other close relatives, were also found to be affected, though not necessarily by the same type of disorder. The known proportion of such instances is, however, still very small.

Among pre-natal causes, congenital malformations such as hydrocephaly and some vascular abnormalities are also found. Multiple pregnancies also contribute disproportionately to the incidence of cerebral palsy: twin status is found from five to seven times as frequently among cerebrally palsied children as in the normal population, in which twinning occurs in approximately 1.2% of births (Asher and Schonell, 1950; Illingworth, 1958).

A high incidence of prematurity (just over one-third of all cerebral palsy cases) has been found in many investigations, though the significance of this fact is often unclear and it is likely that the cerebral palsy and the prematurity both follow from some factor common to both (Evans, 1948; Asher and Schonell, 1950; Dunsdon, 1952; Illingworth, 1958).

Pre-natal cerebral haemorrhages, intra-uterine degenerative and toxic conditions and asphyxia, with which may be included the effects of blood incompatibility between mother and child (the Rhesus factor), all contribute their quota of cerebral palsy casualties.

As regards factors operative at the actual time of birth, a higher than usual incidence of abnormal labour has frequently been noted. Oxygen deficit, occurring through delayed or over-precipitate birth, delivery difficulties due to unusual posture of the foetus, and asphyxiation through cord strangulation, resulting in severe cortical damage, must also be reckoned with some of the other more important causative factors.

Among the post-natal conditions which are thought to account for from 10% to 20% of all cases, meningitis and encephalitis figure very frequently (Perlstein and Barnett, 1952; Illingworth, 1958).

Since all the above-mentioned causative and predisposing factors can result also in mental abnormality, it is hardly surprising that a high incidence of mental defects, deficiencies and instabilities are found among all types of cerebrally palsied handicapped children.

Incidence

Results of surveys made over the past decade in this country show general agreement on an incidence of from 1 to 2 per thousand children of school age. Reports from other

N. European countries (e.g. Sweden and Norway) tend to support these estimates. In certain other places, notably the U.S.A., the general incidence within a comparable age range appears to be somewhat higher, even as much as three or four times as great.

Some slight differences have been found in the relative sex incidence. Most studies in this country and elsewhere have shown a preponderance of males in the 51% to 57% range. This fact is difficult to account for in the light of the higher mortality rates found particularly among premature males (Asher and Schonell, 1950; Dunsdon, 1952; Anderson, 1952; Floyer, 1955; Illingworth, 1958).

As regards the relative incidence of the main cerebral palsy types, there has been general agreement in all the main surveys in this country that spasticity accounts for the large majority of cases, with relative incidence of from 67% to 86%, athetosis and other forms accounting respectively for from 8% to 21% and from 1% to 25% of all.

This matter of relative incidence has practical importance in special education when the planning of appropriate schemes must reflect special needs. When, for instance, distributions of relative incidence in other places (e.g. U.S.A.) appear to differ considerably from those found in our own country, we must guard against too slavish an adoption of schemes which, though they may satisfy the somewhat different requirements in those places, may endanger the adequacy with which the needs of our own handicapped children are met.

In order to have some idea of the special needs which must be met when educational schemes are planned specifically for these children, it is necessary to take account of the variety of handicaps which are found both singly and in combination.

Types of Handicap

(*a*) *Visual.* Although our several modes of sense perception are rarely used in isolation, normal visual perception is obviously of major importance in education, particularly in the earlier stages when basic and other skills are being acquired.

Among cerebrally palsied children, both a wide variety and a high incidence of visual defects have been found by all who have studied this aspect of the total handicap. In seven of the major contributions, made during the past ten years and based on large numbers of cases, the incidence of visual defects among cerebrally palsied handicapped children has been estimated variously at from 25% to 75%. The somewhat wide range of these estimates is probably due in part to the different sources from which the sample populations were drawn, and in part also to the fact that opportunities and facilities for expert ophthalmic examination were not always readily available. However, despite any lack of unanimity regarding absolute numbers, there is obviously agreement that visual defects figure largely in the total of all handicaps which afflict cerebrally palsied children. Most investigators are in agreement, too, that squints and other defects of convergence are the most commonly found ocular defects, occurring as they do in at least 30% of cases; that many of the oculomotor defects are of cortical rather than of peripheral origin; and that particular types of visual defect are not necessarily found in association with any one type of cerebral palsy, nor with any particular grade of mentality. Such defects, whether due to errors of refraction, or to defects of more central origin, are particularly

frustrating to any child, but so much more so to those with other defects and incoordinations. Interests and occupations such as reading, drawing, painting and table games, which provide outlets for so many physically handicapped children to whom the more active recreations are denied, all need levels of co-ordination impossible to a great many cerebrally palsied children, or are achieved by them for short periods only, and with such difficulty that fatigue, in itself, sets close limits on the length of time during which any one occupation can profitably or enjoyably be pursued. This last point is of special importance in the case of the more intelligent of these children, in whom frustration and fatigue are more likely to be in direct proportion to the extent of their disabilities Apropos of this, it is interesting to note that Schachat, *et al.* (1957), for example, found visual defects in 68% of a selected group of children handicapped by cerebral palsy, all of whom had I.Q.'s above 70. On the whole, however, the incidence of visual defects is greater among the mentally inferior children than among those with better intelligence, the greatest incidence being found among the quadriplegics, a large proportion of whom are mentally sub-normal and, for reasons other than poor visual co-ordination, are likely to achieve little in the way of education. Difficulty in spatial perception resulting from poor binocular fusion adversely affects the development of hand and eye co-ordination and may well be a basic factor in the generally poorer than average spatial discrimination shown by cerebral palsied children of all types and grades. Attention was directed to this point by Dunsdon (1952), Guibor (1955) and Woods (1956).

(*b*) *Hearing.* Concomitant with other handicaps, a high incidence of auditory impairments, including total, partial and selective deafness, is found among cerebrally palsied children.

In the course of cerebral palsy studies carried out in this country and elsewhere, about 20% of the children have been found to have impairments of sufficient degree to cause serious disability in hearing and consequently in speech and language development (Dunsdon, 1952; Fisch, 1955; Porter, 1957). Additionally, many workers concerned primarily with general audiology have commented on the strikingly greater proportional incidence of deafness among cerebrally palsied children than among those without this handicap, which they have found in the course of their work. If, however, all degrees of loss from slight difficulty to total deafness are included, the overall incidence rises to proportions as great as 70% (Porter, 1957).

Among deaf children who are not handicapped by cerebral palsy, the impairments of the majority tend to be largely of peripheral or organic type, producing either unilateral, or bilaterally unequal loss. For such children, increase in volume alone, or the use of bone conduction, will often be effective, hearing aids enabling a large proportion of these children to overcome their handicaps sufficiently for them to achieve good levels of executive speech and to understand the speech of others. For children with central nerve deafness and selective high frequency loss, however, hearing aids are of little or no use. In the case of many athetoid children, even the correct fitting and wearing of an aid presents considerable difficulty, while the frequent adjustments necessary for optimum reception often prove quite impossible for a child who cannot control his continual involuntary movements.

(*c*) *Speech.* Obviously, normal speech development presupposes the ability to hear. While the communication of the most basic needs may be achieved by other than verbal means, the development and expression of ideas is seriously hampered, if not entirely prevented, when speech remains undeveloped, or at a level of inarticulate vocalization. It must be remembered that when cerebral palsied children are seriously handicapped from the start by defective hearing, this concomitant handicap aggravates other disabilities of which the (possibly more obvious) motor inco-ordination may be only one, and not necessarily the most handicapping one, of several inextricably interwoven defects. The forging and sharpening of the tools of language is a lengthy process. Curiosity, the desire to imitate, explore and communicate are all, in great measure, dependent upon there being sufficient motivation; this, in its turn, springs largely from sense stimulation, particularly in young children. The range of stimulation to which the normal young child is ordinarily exposed is largely determined by his environment and by his ability to respond to the challenges it offers. Children whose mobility is restricted from an early age either do not receive the necessary stimulation, or are unable to respond to it, or may soon be discouraged from trying to do so. By the age of about 3 years, when most normal children are able to run about and are continually asking questions, more than 40% of cerebrally palsied children have still not achieved even their first few words, while many of those who have made a beginning experience such difficulty in articulation that progress towards verbal fluency and a wider vocabulary is seriously retarded, their speech being unintelligible, or remaining over-long at an infantile level both in quantity and quality.

When language development suffers delay and restrictions, progress in other associated activities and interests is also hindered. Children whose verbal ability is poor commonly show little interest in learning to read for themselves; when deafness is but one factor in a multiple handicap, even the more passive pleasure of listening to others is denied them.

(*d*) *Intelligence.* Throughout the various studies, despite some relatively small differences, there is general agreement that intellectual superiority is rare among cerebral palsied children (barely 0.5% having I.Q. 130 or more), and that mental inferiority is found in a very large proportion of cases (approximately 50% having I.Q. less than 70). Between these two extremes the distribution of ability is markedly skewed, there being a much greater than normal incidence of the various degrees of dullness, approximately one-third of all such children having I.Q.s between 70 and 99 and only about 8% between 100 and 130.

A positive correlation between level of intelligence and extent of handicap was found by Asher and Schonell (1950) and Dunsdon (1952) and by other later workers. Most of these studies show the mean I.Q.s of cerebrally palsied children with only slight and moderate handicaps to lie around 80 and 70 respectively, while, for those with handicaps rated as severe and very severe, the comparable means are about 55 and 25 respectively.

The extent to which potential mental ability may be put to full use is conditioned, however, by a number of other factors, among which a fairly common tendency to seizures

must be taken into account when considering the educational prospects of cerebral palsied children.

(*e*) *Convulsions.* Both major and minor seizures present additional complications, particularly among those children with extensive and severe handicaps and among those who are markedly sub-normal. Illingworth (1958) estimated that probably one-third of all cases have seizures at some time or other. While several other workers have agreed on an incidence of at least 15% to 20% among cerebrally palsied children in the age range 5 to 16 years, there appears to be less unanimity concerning incidence in the pre-school age years. In 52% of the 50 cases seen at Sheffield by Illingworth, the onset of seizures had been during the first year of life, while in a London sample (Pirrie, *et al.*, 1957) the incidence of fits in children under the age of 2 years was stated as only 7%. The matter of age of onset is of particular importance in any consideration of future educational prospects, a point stressed by Dunsdon (1952) who found that, among children who had a history of convulsions within the first 72 post-natal hours, 84% were later found to be mentally inferior (64% with I.Q. below 70) as against 58% (43% with I.Q. under 70) of those whose seizures, if any, were of later onset.

Many seizures which are of a minor type only (petit mal), are not severe enough seriously to interrupt a child's attendance at school or centre, and may be of so short a duration that, as happens frequently when they occur at night, they may even go unnoticed for quite a long time. Nevertheless, it is in just such instances, particularly where such minor seizures are of frequent occurrence, that concentration may be so affected as seriously to reduce any expectation of educational progress.

(*f*) *General psychological implications.* Such then are some, though not all, of the more obvious difficulties which, even occurring in isolation, would each and every one of them be sufficient reason for special educational provision.

Unfortunately, there are in fact very few cerebrally palsied children who are handicapped in only one of these ways: most have at least one or more of the perceptive defects in addition to the often more patently obvious motor defects. It is important, therefore, to bear in mind the words of Gesell and Amatruda (1947) who wrote: " . . . the gravity of any sensory defect . . . cannot be appraised purely in terms of sensory acuity, or sensory motor efficiency. The total effect upon the developmental organization of the child is most in need of critical diagnostic appraisal."

The need to estimate the effects on the child as a whole person, rather than as an aggregation of " factors," has not always received the attention which it deserves. However, in a recent book, Bronson Crothers, one of the earliest American paediatricians to make long-term and intensive studies of the condition, surveys critically some twenty years' work in the field and makes an honest evaluation of it in terms of its ultimate value to the patient. His main conclusion is that the core of the problem, how to ensure the best possible eventual adjustment of cerebrally palsied children to normal living, can be reached only by studying the changing effects of multiple handicaps on the whole personality at different stages of growth and development. From a mass of clinical evidence, the only certain things to emerge were that cerebrally palsied children have an infinite variety of motor deficits, some classification of which is possible, and that mental ability can be assessed to a considerable extent, but that there is otherwise little that can be quanti-

fied for use in comparative studies of large groups, while " . . . the best charts in the world give very little information about individual cases."

Apart from such instabilities of temperament and personality as may seem to result from the convulsions and seizures that are so prevalent among the more severely handicapped, all cerebrally palsied children, even those most slightly affected, are particularly liable to a succession of frustrations and disappointments in their attempts to achieve some degree of independence and, to quote Bronson Crowthers again, " . . . the difficulty is that these children grow and develop and are dependent over a considerable period." This " considerable period " may in fact be the whole of their lives and, though eventually (and necessarily) habituating themselves to abnormal degrees of protection and the receiving of concessions during what are often long years of both physical and educational " special treatment," many of them, particularly the more intelligent, do not ever reach a state of total acceptance. If, and when, either depressed by restrictions imposed by treatments which have given minimal results, or unrealistically over-optimistic about their chances in a competitive world, they attempt too soon to meet the demands of ordinary living, without the concessions to which for so long they have been accustomed, an appreciable number are unable to face the fact of their inevitably continuing limitations and, in consequence, suffer what may become intolerable stress.

Since most cerebrally palsied children, unless very slightly handicapped, can never make the normal, uninterrupted progression from a state of complete protection to adult independence, it is of the utmost importance that, both at home and at school, pressures and concessions appropriate to age and handicap should receive unfailingly careful attention. There is an increasing awareness, among those who work with and for these children, of the need to take into account not merely those particular aspects of the handicap in which they may primarily be interested, but also the child's general growth and development in its physical, psychological, educational and social aspects, the extent of individual needs in all these spheres and the degree to which, at any one time, they are concomitantly being met.

In considering such needs, whether at home or school, Gibbs (1958) cautions against unrealistic thinking. " It is important," she says, " . . . to realize two points about needs: one is that all the basic needs found in normal children and adults cannot usually be met if the cerebral palsy is more than very mild; the other is that the affected child may have needs which do not exist, and which therefore do not have to be met, in physically normal people." She goes on to quote Guensberg's opinion that fundamentally healthy emotional growth calls for an environment in which there is parental affection, a feeling of belonging to a family unit and sufficient opportunities for self expression and recognition as an essential part of it. The first and second of these needs, Gibbs says, are usually met, sometimes to such extent as even to be detrimental to the other normal children in the family, and instances of overt rejection are comparatively rare. She adds, however, a further point of particular interest to teachers, both when assessing the influence of the ostensible home atmosphere on a cerebrally palsied child's school behaviour and when considering the well-intentioned attempts at school to make a child feel as " normal " as possible. Some children, she has noticed, sense " rejection " when parents refuse to recognize the existence of the handicap, while indiscriminate praise, especially at school,

can be felt as an insult, particularly among children in their 'teens. When parents or teachers fail, for any reason, to adjust their demands to the limits set by the handicap, the results can be far-reaching. Not only can a sense of inadequacy and failure be continually aggravated, but compensatory and entirely unrealistic ambitions may be conceived which, being never possible of fulfilment, may contribute in no small measure to emotional breakdown at a later age.

Education

While special educational treatment is necessary, in one form or another, for as many cerebrally palsied children as can benefit and, in itself, will often provide a form of psychological therapy, the difficulties which beset all who are concerned in making a decision as to what, if any, form of education will best be suited to any individual child, can be so complex as to seem at times almost insuperable. Two questions in particular need to be answered: should all cerebrally palsied children, except perhaps those with only the slightest involvement, be educated in exclusive groups?; and should consideration of serious single major sensory deficits be given priority over other aspects of the handicap, the child to receive his education among blind, deaf or crippled children whose incapacities do not extend beyond the limits which their relatively contained handicaps impose? Unfortunately, no one answer can be given, even to such fundamental questions, since whatever the pros and cons for acting on either of these general principles, the ultimate decision in the case of any one child needs to be made with reference to the child as a whole person, the totality including both present assets and liabilities and, where predictable, such prospects as are likely to be his in both near and more distant future. For some whose main difficulty is a sensory deprivation, or for those with only slight general motor handicap, and for whom it would not be unreasonable to envisage a useful degree of social and economic independence, the problem is slightly less difficult to resolve. For some with cerebral palsy, schools for physically handicapped, deaf, blind, partially sighted, educationally sub-normal, or ordinary primary or secondary children may well provide more suitable environments than schools intended exclusively for cerebral palsied children, but with the proviso that other aspects of the total handicap are not forgotten. Apart from actual teaching methods and the possible necessity for modifications of apparatus and aids usually employed, there are matters which may seem of only incidental importance, but which will sometimes have a surprising influence on the child's response. Many of these matters are essentially practical and include such details as schoolroom furnishings and type of floor covering; size, acoustics and lighting of rooms; accessibility from the classrooms of wash rooms and lavatories, and other matters relating to general physical comfort.

Even the relative position on the timetable of subjects covered on any one day, a detail occasionally subject to administrative expediency, may have more than a negligible effect on the effort of which a child may be capable towards the end of a school day. Realistic planning for special educational treatment, whether in day or boarding school, needs to take into account all such details; in the case of residential schooling, where the transition from home to school life involves the bridging of many gaps, the need is even greater.

The first special school exclusively for cerebrally palsied handicapped children of school age was opened at Croydon, under voluntary management, in 1947. Between then and the present time, 17 schools have been established: 3 by Local Authorities, 6 under voluntary management and 8 independently maintained by voluntary societies. At all these schools, entry is restricted to children of school age and, with 2 exceptions, capable of benefitting in some degree from education in the formal subjects. The exceptions are one independent boarding school for subnormal children and another established as a classifying and experimental centre for children with severe handicaps whose probable degree of educability cannot readily be graded without prolonged study and investigation.

In addition, there are also 2 cerebral palsy units in special residential schools provided by Local Education Authorities and 12 day units attached, in all but one case, to L.E.A. special schools for physically handicapped pupils. Of 9 cerebral palsy units provided in connection with hospital schools, 4 are day units.

Concerning cerebrally palsied children of nursery school age, or at any rate too young for formal education however " special," Dunsdon (1948), in a discussion of future needs, wrote as follows: " . . . special schools or centres are required, some of which will need to be residential, and all of which may need to provide, in varying degrees, facilities for physical treatment on the premises, since most of these children will be too handicapped to be taken easily and regularly to and from out-patient clinics. Such schools and centres need to be for all ages, including nursery classes, since among this (age) group, in particular, are to be found many children whose physical signs include motor patterns which are referable as much to bad habits of movement as to the prime cause of the handicap, and others whose socially dependent attitudes are often unnecessarily perpetuated by well-intentioned, but short-sighted, indulgence on the part of their families."

Ten years later, Cohen (1958), in drawing attention to the importance of " early and accurate diagnosis of cerebral palsy in infancy," expressed regret that " the services provided by voluntary bodies have inevitably tended to reproduce gaps created by legislation between the statutory educational, health, and welfare services." In fact, since the establishment in 1948 of the Midland Spastic Association's school at Birmingham, very little provision of the type suggested has been made. The need to close the gap between early diagnosis and subsequent treatment has, however, in recent years, received more general recognition and closer attention. Some excellent work is now being done for pre-school children, stimulated in great measure by pioneer work, particularly at 4 centres, which opened between 1948 and 1955, these being: Carlson House, the Midland Spastic Association's day school at Birmingham, opened in 1948; Claremont School, established in 1952 by Bristol Education Committee; The Percy Hedley School for Spastics, opened by a charitable trust at Newcastle in 1953; and the Cheyne Centre for Spastic Children, opened in 1955 with money from voluntary sources, and since maintained jointly by the South West Metropolitan Regional Hospital Board and the L.C.C Education Committee.

In the case of many cerebrally palsied children, and in particular those for whom the individual attention given at a special school for cerebrally palsied children has been necessary, another gap has to be bridged before they can expect to enter a competitive world. Although reasonably well-adapted to life at a special school, adolescents who,

until school leaving age, have spent the greater part of their lives in sheltered environments often find unexpected difficulty in keeping jobs, even those well within the scope of their abilities. It takes a little while for some of them to realize and to accept the fact that the successful holding of a job in the ordinary community involves keeping it not *because* of an handicap, but *despite* it. In other words, for the cerebrally palsied in particular, " training for work " means not the achievement of specific job proficiency alone, but learning to do without much of the physical, mental and emotional bolstering to which they have become accustomed.

It was with such a need in mind that the National Spastics Society in 1957 opened Sherrards at Welwyn, Herts. This is a training centre for cerebrally palsied young men and women who, though rated "unemployable" when they first enter the Centre, are expected to make sufficient progress while there to be placed eventually in " light industry" work in the vicinity of their own homes or, failing this, be found work in a sheltered workshop, which will afford them at least some degree of economic independence.

Although the actual establishment of special schools and centres was not originally among the aims of the British Council for the Welfare of Spastics, in 1955 it opened " Ponds," a Home in Buckinghamshire for very severely handicapped young adults and adolescents between the ages of 16 and 21 who, though of normal intelligence, were unlikely ever to achieve economic independence. A varied programme of informal education is provided, with opportunities of more formal tuition for those able to benefit.

For those whose handicap is very severe indeed, participation in most of these schemes is, of course, precluded. In many instances, though not of course all, the degree of comitant mental subnormality is such as to require, in any case, some form of custodial placement, whether private or otherwise, if continued care in their own homes proves impossible, or for any reason inadvisable.

Conclusion

It will be seen, therefore, that although for some time the provision of special educational schemes, specifically designed to meet the needs of some of the children with this complex handicap, was lacking in many respects, a great deal has been achieved during the past ten years, though much still remains to be done. One matter, however, still calls for further attention. Despite increasing reference to the subject in the curricula of Teacher Training Colleges, University Departments of Education and some of the shorter Special Courses for experienced teachers, there is still need for more intensified and thorough experimental work before special methods can be evolved which will enable cerebrally palsied children to derive the maximum benefit from even those educational facilities so far available.

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FREQUENCY COUNTS AND THEIR USES

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"Driver, stop—the postilion has been struck by lightning."

"I should like to see a collective farm equipped with modern sewage disposal unit."

IN anticipating the needs of their customers, the compilers of phrase-books for tourists face the problem of selection. How can they tell which phrases will be most frequently required in the unforeseen emergencies of the tourist at large on the Continent? Presumably most phrase-books are constructed by a mixture of common sense, imagination and personal experience. Yet a more thorough method would be to find out what phrases were in fact used by a sample of travellers. If the sample were large enough and representative, such a survey would provide a basis for a phrase-book which would have fewer serious gaps, and fewer unnecessary or unlikely requests, than one compiled in an arm-chair by the fire-side. Frequency alone is not an adequate criterion for the selection of words or phrases for such a book. "Art gallery" may occur in tourists' questions more frequently than "lavatory," but there may be occasions when the less frequent word is more important to know. But frequency of usage is an important consideration, and in the absence of any such count, the author of a phrase-book must try to envisage the relative frequency of various situations, as well as to evaluate their importance.

A similar problem exists in education for the author of a text-book or of an infant reader, and for a teacher planning the curriculum in foreign languages, in spelling and even in arithmetic. On what principle should he make his selection of material, his choice of exercises? Obviously, *basic* items, necessary for the understanding of subsequent stages, should appear early in a syllabus, though even here considerations of frequency will enter into the choice of examples and illustrations. Certain *essential* items may claim priority: the English word "poison" occurs in print only about once in every 40,000 words, but it may be rather important to recognise it when it does appear. The *frequency* of usage is a third category of priority. If from some count of frequency we know which items or problems or words are likely to occur most often in the application of the skill to be learned, we can plan the instruction more efficiently.

It was once believed that children should be given difficult tasks at all stages in order to train their minds. With the discrediting of this theory, the curriculum has been cleared of many of its more obvious absurdities. No longer do we find arithmetic text-books with examples such as: "Multiply 16 tons 4 stones 2 ounces by 473." Winston Churchill tells in *My Early Life* that in his first Latin lesson he learned the vocative case of "mensa"—"O table"—and was reprimanded for questioning its importance. Matthew Arnold, in one of his reports as an inspector, complained of infant readers which contained

such sentences as: "The crocodile is viviparous: quick-silver, antimony, calamine, zinc, etc. are metals." Common sense and experience have taken us a long way in relating the content of curriculum and text-book more closely to the pupil's present and future needs. The method of frequency counts is an attempt to refine the intuitive common-sense approach. Perhaps some of the more fervent adherents of frequency counts have refined the approach so much that common sense has disappeared altogether. The idea of such counts has suffered (like intelligence testing) from exaggerated estimates made of their importance in the early days of their development. A review of the research in this field, however, will show how much of value has already been done, and will indicate the ways in which this technique of educational research can be applied and developed.

Word Counts and Spelling

An excellent brief account of the history of word frequency counts is given in the report of the recent Australian vocabulary survey (Schonell, 1956; pages 18-27). A more detailed account is to be found in Bongers' *Vocabulary Control* (1947) or in Fries and Traver's *English Word Lists* (1950).

Early studies of word frequency were in the nature of curiosities rather than of research. Classical scholars of Alexandria noted certain words which appeared only once in the text of Homer; and devout persons through the ages have laboured to compile statistics on the words of the Bible. A Victorian scholar, Thomas Hartwell Horne, spent seventeen years of his life counting chapter, verse, word and letter of the Bible, and was able to report that the Bible contains 3,566,480 letters and 773,693 words, among which the word "and" occurs 46,277 times.

However, serious practical application of a frequency count was attempted first in stenography and then in spelling, where it has obvious relevance. Later, the idea was extended to the teaching of foreign languages and of reading and to text-book construction in various subjects where the appropriateness of the technique is more open to controversy.

The German Stenographers' Congress of 1891, at the suggestion of Kaeding, undertook a count to discover the relative frequency of all the different word-forms in the German language. This investigation (published in 1898) employed 5,000 stenographers and covered eleven million words. It established a pattern for future counts, though it was of limited value for education, as every word form, even singular and plural, was counted separately, and words which have several meanings—as, in English, "May" (month) and "may" (verb)—were not distinguished.

In spelling as in stenography, the form of the word is a dominant consideration; and the principle of frequency as a basis for the selection of words to be taught was soon applied to spelling. On this principle, a pupil should learn first to spell words which occur frequently; words used rarely can be learned later or looked up in a dictionary. In 1898, the American, Rice, originator of many applications of experimental methods to educational problems, published *The Rational Spelling Book*, a study of the comparative frequency of various English words for spelling. This was followed by a number of investigations, mostly American, in the period 1900-1920, in which miscellaneous written

material was gathered together and the frequency of the words used was computed. These studies were notable mainly for the mammoth labour involved: one study by Jones in 1914, for example, analysed a count of 15,000,000 words from children's compositions. The investigations of this period demonstrated that a small group of words in English occur so frequently that they account for a large proportion of the total number of words used in writing. Thus Cook and O'Shea in 1914 reported that in their count of 200,000 words, 42 words accounted for 50 per cent of all the words encountered in their analysis, and 763 words covered 91 per cent of the total.

It is not so easy, however, to apply this finding to the selection of words for spelling. The very common words are mostly "structurals" (like the verb "to be", auxiliaries, prepositions, articles and so on) which have little precise meaning apart from the particular context in which they happen to be. In contrast to "structurals" are "content words" (common nouns, for example) which are equally necessary in speech or writing, though few of them occur very frequently. This is a fundamental point in frequency counts. It is one reason why frequency is not a simple index of the importance of a word.

There are at least three other considerations which must be weighed in framing a curriculum for the teaching of spelling. The first is the growth of children's vocabulary; if we accept that children should know and use a word in speech before they learn to spell it, it follows that we must consider the frequency of words not merely in adult writing but also in children's vocabulary at different ages. The second consideration is the level of difficulty of the spelling of a word; "aeroplane" may occur more frequently than "train" in young children's writing, but its length and the initial diphthong may still make it unsuitable for an early spelling lesson. The third is the frequency of the errors which children actually make in spelling; the teacher may rightly decide to concentrate attention, particularly in the later stages, on words commonly mis-spelt. A count of common errors is needed to supplement the information on frequency of usage.

The compiler of a spelling list must therefore try to balance these various considerations. We have mercifully passed the stage in educational theory where the last of the three considerations, concentration on difficult words, excluded all others. Complaints that pupils leaving school are poor at spelling are not necessarily a sign that spelling is given inadequate attention. The cause may be that the attention given to spelling is misdirected, in that the pupils are set to learn the spelling of words which they never use, to the neglect of those which they have to use frequently. Schonell reported that he had once discovered the following twenty words set as a spelling lesson for a class of thirteen-year-olds: deceased, dissent, deciduous, decrepit, deferred, demeanour, deteriorate, dexterous, diarrhoea, dinghy, diphtheria, disagreeable, disastrous, disinfectant, disobedient, dispensary, draught, dual, dyspepsia, eccentric. Are any of these words appropriate to that age-group? One learns to evaluate such material by experience in teaching, but experience is a slow and costly method. Research work in this field, and the use of text-books soundly based on the findings of such research, will supplement experience and support the less experienced teacher.

Examples of the "scientific" method of framing a spelling curriculum may be taken from spelling books used in Scottish schools over the last forty years. A text-book which was introduced in the 1920's was Boyd's *Standard Spelling List*. This list made use of the

word frequency counts of the period, modified by teachers' assessments of the difficulty of the words and by analysis of the errors actually made by pupils in preliminary trials of the list. A description of the technique is given in Boyd's *Measuring Devices in Composition, Spelling and Arithmetic* (1924; pages 87-146), in which the problems of compiling such a list are thoroughly discussed. In many schools in the 1930's, Boyd's list was replaced by Schonell's *Essential Spelling List*, which also was based on word frequency counts supported by classroom trials. More recently, the Scottish Council for Research in Education has published *The Scottish Pupils' Spelling Book*; the vocabulary of this book was derived from a count of the words in 70,000 compositions written by pupils in Scottish schools.

Although the principle is now well established that the construction of a spelling primer should make use of the results of frequency counts, we can never expect a purely objective assessment of frequency to provide a "perfect" or adequate list of words. Other considerations being equal, the more frequently used word should be included in preference to the less frequent. But frequency counts do not solve the problems of compiling a spelling list; they merely provide the author with relevant evidence on which to make the necessary decisions.

Problems of Classification

In 1921 Thorndike published *The Teacher's Word Book*. This classic text gave a list of the 10,000 words found most frequently in a count of 4,000,000 words taken from 41 miscellaneous sources (including the Bible, various classics, school-books and magazines). The second edition (1932) added counts from 200 other sources and gave the 20,000 most frequent words; and the third edition (1944) raised the figure to 30,000 words on the basis of further counts. The main part of the latest edition is a list of words occurring at least once in every million words reviewed. (A supplementary section lists those which occurred in the frequency range once in 1,000,000 to once in 4,000,000 words.) For each word five figures are given. The first figure is the average number of occurrences per million words; the other four figures give the frequencies in four different types of material. These extra figures are intended to meet the criticism that Thorndike's original list had a biblical and literary bias; for example, the word "couldst" originally was shown as having a higher frequency than the word "couldn't". An intelligent interpretation of the data given for each word now enables the user of this list to take into account the range of occurrence as well as the mere frequency.

However, Thorndike's list is essentially a list of word forms, on the model of Kaeding's original German count. For example, the separate meanings of homonyms (such as "art," "will," "miss," words in which one form represents several meanings) were not distinguished. Much of the subsequent work has been concerned with establishing sound principles of classification which will enable the results of counts to be applied more effectively to vocabulary selection for the teaching of languages.

The first problem is that of finding a definition of what a word is, for every definition leaves disputable cases. Is "cannot" or "motorcar" ("motor-car," "motor car") or "house-boat" or "boat-house" one word or two? "House" and "houses" are surely

the same word; but is "mouse" a different word from mice? Are "wrote" and "written" different words, and how does one deal with "am," "is," "been" and the other forms of "be"?

It is not sufficient to deal with this problem arbitrarily by definition and to claim that there is no problem provided a consistent rule is observed, for there is the further difficulty that words are not wholly independent units of language since their meaning is always dependent to a greater or less extent on the context. In the phrase "How do you do?" it is wrong to count the word "do" as appearing twice or as appearing once in each of two meanings, for the whole phrase is a "formula" with a unity and meaning of its own. Watts, in *The Language and Mental Development of Children* (1944, pages 66-67), gives a brief summary of this distinction between "formulae" and "free expressions," a distinction first made by the linguist, Jespersen. Similarly, the word "account" appears high in the Thorndike list (more frequent than 100 times per million words) not because of any commercial bias in American vocabulary, but because of the "formulae" in which it appears. We know from a semantic count (a count in which different meanings are kept separate) that "account" has a financial meaning in only 10 per cent of the usage of the word; in 15 per cent of the usage it is "account for" (give reason); in 35 per cent it is "give an account of" (story); in 33 per cent it is in other phrases (e.g. "on account of"); and in 7 per cent it has other minor meanings.

One solution is to construct a separate idiom list, to supplement the word frequency list. An alternative is to use the system of "head-words" developed by Palmer, whose work in the Institute for Research in English Teaching, Tokyo, established several important principles which have been accepted by many research workers in this field. By this system various forms of words, together with short phrases in which the words appear, are classified under the single head of the basic form. Thus the head-word "clear" includes "clearing" (verb, noun), "cleared," "clear" (verb, adjective), "clearly" and "clearance."

Palmer's aim was to identify a limited number of frequently occurring head-words which would serve as a sound basis for the learning of a language, a "core" vocabulary which would carry the beginner quickly to the stage where only specific words of relatively rare occurrence would remain a difficulty to him. In English it has been shown that the thousand most frequent such words account for about 90 per cent of all the words used; a vocabulary of 3,000 well chosen words will enable a reader to recognise some 95 per cent of words in print.

In 1934 a conference in New York brought together several word counters to compile an agreed list. The list appeared in 1936 in a document known as the "Carnegie Report," classified by head-words. Meanwhile Thorndike and Lorge set about the immense task of organising a semantic count in English. The results of these two studies are brought together in Michael West's *A General Service List of English Words* (1953), a list of some 2,000 common words in English with the frequencies of the various meanings given separately. In this list, for example, the word "game" is shown to have a frequency of 638 in a count of 5,000,000 words. In 9 per cent of these occurrences it had the meaning "children's play or amusement"; in 39 per cent it meant "competition" as in football or

card games; in only 5 per cent did it refer to game-birds. Therefore the first two of these meanings are recommended for the beginner; the third should be left for the advanced student.

Specific Vocabularies

There have been many word counts in addition to those mentioned above. The most comprehensive bibliography of publications on frequency counts is by Dale and Reichert, *Bibliography of Vocabulary Studies* (revised edition, 1957). In this volume, Section D lists work on "Frequency of appearance of words" and gives 120 references; Section J, "Spelling vocabulary," has 51 references; Section K, "Studies of specific vocabularies," has 289 references; Sections M to O, on the vocabulary content of newspapers, periodicals and radio, have 48 references; and Section X, "Studies of words used in writings and conversation," has 109 references.

Many of the studies listed in this bibliography are analyses of specific vocabularies, rather than of the English language as a whole. Thus, separate counts have been made of oral and written language, of words used in magazines, novels and newspapers, or of children's speech or writing at different ages. The last of these is almost a branch of developmental psychology, for it reveals the manner in which children build up their vocabulary. It is also of value as a guide to the vocabulary which a teacher can assume an average pupil to know. A recent example of such a study is Burns' *Vocabulary of the Secondary Modern School Child* (1959), in which a discussion of the uses of this kind of list will be found on pages 16-17. Another example is Burroughs' *A Study of the Vocabulary of Young Children* (1945), one of the few references missed by Dale and Reichert in their bibliography. In *The Education of Slow Learning Children* (Tansley and Gulliford, 1960) the authors mention this and other word counts, and observe that no comparable list of the speech vocabulary of ESN children is available. There are certainly great possibilities for research in this field; the vocabularies of specific groups of children can be compared with the standard vocabulary lists to provide information which may both improve understanding of the group of children studied and also indicate the appropriate vocabulary for their text-books and for class-room teaching.

A vocabulary list derived in this way from limited and fairly homogeneous material may seem to escape the objection which has been levelled against the "general" list. Lists such as Thorndike's are supposed to be representative of the whole language because they are based on widely heterogeneous material. But general English usage is not found by taking an average between the Bible and the popular magazine. (It is interesting to note that a similar criticism is often made of the method of the Binet Scale of Intelligence, in which a "hotch-potch" of abilities are tested to give an assessment of general intellectual ability). Bongers (1947) discussed this criticism, and gave his answer:

> " It is a mistake to think that if one mixes a sufficient number of texts of the most widely different varieties, an average taken will give figures applicable to everyday language. Mixtures of either small or large proportions of widely different material are not representative of general language; they are representative of nothing.

> " The only way in which counts on material outside the range of normal everyday language can be turned to account is to take such large quantities of each kind that every department represents a word count in itself and produces lists valid for that kind of material only. Then a secondary list may be compiled of words that are common to all the primary lists. The number of primary lists in which a word figures may furnish a valuable range rating." (page 99).

The use of the range (the number of different sources or types of material in which a word occurs) as well as the frequency of a word is an important refinement of the technique of frequency counts, a further complication which must be taken into account in attempting to base vocabulary selection on strictly objective principles.

Bongers' answer, however, does not fully meet the objection, which can be applied to all vocabulary counts, however specific they set out to be. The assumption that a definite frequency of vocabulary can be established for any group, whether an age-group or a nation, is likely to be challenged. Every person has his own vocabulary, and frequency of usage varies not only between persons but even between different situations for one person. The vocabulary a person uses during a day spent in travelling is different from that which he uses in business, on holiday or in the school. Each author has his favourite words as well as his blind-spots of vocabulary; different newspapers use different phraseology. Can any mixture of samples, however extensive they may be, provide a general frequency list for a language spoken by so many different people in so many different situations? Part of the answer is that the differences between persons and between situations show up in "content" words, while the frequency pattern of "structurals" remains remarkably constant. Again, the objection applies more to massive lists like Thorndike's than to the shorter lists of more frequent words, like the General Service List. The recent French study, which will be described below, faced this problem, and the method adopted there may be the only practicable answer to this difficulty.

Word Counts in Foreign Languages

Apart from the German study of 1891-98, it was not until the 1920's that frequency lists in languages other than English began to appear. The American and Canadian Committees on Modern Foreign Languages in particular were responsible for stimulating and publishing much of this work, and it is unfortunate that so many of these publications are now out of print. Some impression of the variety of word lists now available may be got from the following brief selection of examples; for a detailed bibliography, see Sections D and K in Dale and Reichert, *Bibliography of Vocabulary Studies.*

In French the lists include Henmon's *A French Word Book* (1924), Vander Beke's *French Word Book* (1929) and Cheydleur's *French Idiom List* (1929). The recent list, *Le Francais fondamental*, is described below. Examples of German frequency counts are Morgan's *German Word Frequency Book* (1928) and Hauch's *German Idiom List* (1929). In Spanish, Buchanan's *A Graded Spanish Word Book* (1927) and Keniston's *Spanish Idiom List* (1929) also date from this period; more recently in Spanish are *Vocabulario usual, comun y fundamental* by Garcia Hoz (1952) and a word count in Puerto Rico by Rodriguez Bou (1952). In Latin there is Diederich's *The Frequency of Latin Words and their Endings*

(1939); in Dutch, De la Court's *The Most Frequent Words and Collocations in the Dutch Language* (1937). Brown, Carr and Shane published *A Graded Word Book of Brazilian Portuguese* in 1945. In 1947 Russo combined previous studies into *A Combined Italian Word List*, and Josselson published *Russian Word Count* in 1953. Work has also been done on the languages of India, in Bengali by Chaudhury (1931), in Telegu by Krishna Rao (unpublished), and in Hindi by Singh (in preparation). The references of other Indian studies which are understood to have been done have not been traced.

Applications in language teaching

How should a frequency list be used in selecting the vocabulary to be learned in a language course? The application is not quite so obvious as may appear at first sight. The order of the frequency of occurrence of words is not the order of their importance or of their difficulty. There are other considerations besides frequency: the similarity of the foreign word to the native form, the complications of irregular forms and idiomatic usage, the appropriate timing of the teaching of grammatical forms, and, of course, the intrinsic interest of the course. Where there is a choice, it is better for a pupil to learn a frequent word than a rare word, an everyday word than an unusual literary or archaic word: "buy" rather than "purchase," "enemy" rather than "foe." The double aim in such selection is to save the beginner from the burden of rare words which it is unlikely he will meet, and also to ensure that all words which are of frequent occurrence are included as early as possible in the course. But what may seem a simple matter of choice is in fact seldom simple. "Basic English" is an example of a system of language teaching which does not rely on the frequency principle; its author, Ogden, has been one of the severest critics of word counts.

Vocabulary selection should be based on some principle and must not be left just to chance. It is mainly a matter for the text-book writer rather than for the teacher, though the teacher should understand the methods of vocabulary selection so that he may be able to identify the well-constructed book. There is a sound case for taking frequency of usage into account in this matter. It is obviously better for a beginner to learn a relatively small number of useful words than a large number of relatively useless words. At a later stage, if I find in learning Russian that my knowledge of vocabulary is weak, I can use a list of the most frequent words to check the more serious gaps in my knowledge. These words written on cards, English on one side, translation on the other, can be reviewed in the odd empty moments of the train journey, the queue, the wait in the restaurant, words known going into one pocket, those still elusive into another. An American firm publishes sets of such cards, ready printed, covering the thousand most frequent words in various languages.

Yet the words which will be useful for me may not be useful for another person. The ideal word list will depend on the use to be made of the language. If I am learning the language for travel, the vocabulary I need is very different from the vocabulary suited to the reading of literature; and that for scientific writing is different from classical literature. Using West's classification, we may distinguish four categories of words in the vocabulary of a language:

(*a*) Essential words, the 300 or so structurals which make up the connective tissue of the language;

(*b*) General words such as "say" (which is a general word for "reply," "ask," "declare"), "take," "get."

(*c*) Common environmental words such as "food," "eat," "sleep," "house."

(*d*) Specific words such as "chalk," "pencil," "spanner," "ticket," which are important in special situations.

The frequency list can help to identify the first three of these; it is not easy to predict the learner's future needs in the fourth category. This point is brought out clearly in the work of the French Commission on *Le Français fondamental*, formerly known as "Français elémentaire."

The purpose of this study, which began in 1951, was to make easier the learning of French by the many French subjects in territories overseas whose native language is not French. The word list was not to be a "basic French," a special form of simplified French, but was to be a "core" of the natural language, an introduction which would give a working competence in the language and also lead naturally on to further study. The results of the investigation appear in *Le Français fondamental* (2nd edition, 1959) as a list of some 1,300 words and 152 grammatical usages. This is a book for teachers—not a prescribed course of instruction but a guide in their teaching to enable the pupils to derive the maximum value from it. The method by which the lists were constructed is described by Gougenheim in *Revue de l'enseignement superieur* (1959).

As the aim was fluency in spoken French, the survey was based on recordings of conversations. 163 conversations, totalling 312,000 words, were analysed. 38 words occurred so frequently that they accounted for half of all the words recorded. This does not mean, the author points out, that with 38 words one can understand half of what is said, for these words were mostly "structurals" and the only verbs included among them were: "etre," "avoir," "faire," "dire" and "aller." This stage of the inquiry identified the words frequently used in speech. For example, although in written French the words "casser," "rompre" and "briser" are used with approximately equal frequency, in the spoken French recorded "casser" occurred thirty times, "rompre" three times and "briser" twice. "Casser" therefore appears in the list and the other two are omitted. A similar analysis of grammatical usages enabled the authors to identify common forms which ought to be included in the early stages of instruction, and to distinguish these from forms which occurred so rarely in speech (such as the simple past tense or the subjunctive) that they could reasonably be left to the advanced student.

The count of frequency, however, was not in itself adequate to provide a minimum working vocabulary. For example, the word "autobus" occurred only three times in 312,000 words. Such words (the author quotes also "dent," "coude," "cuiller" and "metro") "are tied to special circumstances": they are needed mainly in certain situations, each situation having its group of relevant necessary words whose actual frequency of usage will depend on the frequency with which the situation occurs or is spoken of. Consequently, the compilers "determined to place opposite each other two kinds of vocab-

ulary: a frequency vocabulary which comprises essentially grammatical words and verbs with also adjectives and a few nouns of general character, and an availability vocabulary composed essentially of concrete nouns with the addition of some adjectives and also of some verbs which are linked to special concrete ideas." The method by which the Commission subsequently collected the material for the availability vocabulary ("le vocabulaire de la disponibilité")—from lists produced by pupils in French schools—is open to question. But the method of collecting separately the two kinds of vocabulary seems an effective line of solution to the problem of "content" words in frequency counts. The Commission advises teachers to add further words "to suit the particular needs of diverse regions and circumstances."

Teaching English as a Foreign Language

The idea of compiling a similar minimum list for the teaching of English as a second language has been the purpose behind many of the researches into the frequency of English word usage. At one time when Churchill expressed interest in the possibilities of a basic English, on the grounds that the influence of Britain was closely associated with the spread of English as an international language, it looked as if we might have an officially sponsored investigation of the type which has now been completed in France. But the Frenchman's attitude to his language is different from that of the Englishman; and it is to Australia that we must look to find a nationally sponsored survey in English.

The flow of immigrants from European countries to Australia in the 1950's made urgent the teaching of those who could not speak the English language. A group of research workers under Professor Schonell undertook a count of the speech vocabulary of Australian workers, and the resulting word list was published in *A Study of the Oral Vocabulary of Adults* (1956). Reading the description of this survey in the first half of the book is an ideal introduction to the technique of frequency counts for anyone who wishes to have a practical illustration of the difficulties involved and the methods of tackling them.

The final list was based on a total of 512,647 words recorded in interviews with over 3,000 persons. The words are classified under Palmer's "head-word" system. The first thousand head-words in order of frequency covered 94 per cent of all the words recorded; and these words are listed as a guide in the construction of text-books for immigrants who do not speak English. Special attention was given to idioms: over 7,000 different idiomatic usages were listed and on the definition of "idiom" adopted there was one idiom in every seventeen words used. The list of some 200 of the more frequent idioms, with examples of their use, is a valuable part of this publication.

Both these recent studies, the French and the Australian, which may be taken as examples of the most recent development of the word-count technique, were planned to meet a strictly defined and limited purpose. We seem to be moving away from the original idea of a massive general list of the Thorndike type towards the specific inquiry whose results have a direct application in a more limited sphere.

Readability

One development from word counts is the estimating of the readability of a passage or book. What is it that makes a book readable in the sense of easy to read and understand? Many factors are involved besides the intrinsic interest of the subject-matter. For example, long involved sentences with ponderous Latin words are usually more difficult to read than short sentences with short words (though it is always possible to find exceptions). Among the factors which influence readability are: length of sentence, complexity of subordinate clauses, the use of prepositional phrases and the use of abstract nouns or the passive voice of verbs in place of simple active verbs. Frequency lists enter into the assessment of readability since rare words are usually more difficult than frequent words. None of these factors apply in every case: the frequency of a word is certainly not a reliable index of its difficulty.

We generally assess the readability of books which we propose to use in school by a vague intuitive judgement. It would obviously be of value to have a formula available by which readability could be assessed objectively on a scale. There are several such formulae available. The method by which these have been developed is to make a count of various measurable qualities in a piece of prose (e.g. number of different words used, proportion of words containing certain prefixes and suffixes, proportion of words not found among the frequent words in word lists, together with the more obvious measures such as average sentence length), and to see which of these agree most closely with the combined judgement of several personal estimates of difficulty. It has been found that the use of a few such measures in weighted combination is sufficient to give a fairly sound assessment of readability. Some of the formulae are laborious to compute. Others are simple but possibly less accurate. All show a fair measure of agreement with each other and with personal subjective impressions of readability; but none is outstandingly superior to the rest. A detailed review of research on readability will be found in Betts (1949), which gives 143 references and describes in detail some twelve readability formulae.

The Dale-Chall formula (1948) is an example of a method which uses a frequency list. It is based on two factors: average sentence length and the proportion of words encountered which are not in the Dale list of 3,000 common words. The method of Flesch (1951) dispenses with the laborious consultation of word lists and uses the number of syllables per hundred words as a crude but fairly efficient measure of vocabulary difficulty. His method gives two separate assessments: "reading ease," which is calculated from the average sentence length and the number of syllables per hundred words; and "human interest," calculated from the proportion of "personal" words and sentences (e.g. personal pronouns and words of masculine or feminine gender; sentences in the form of direct speech, questions, commands). These techniques may be applied to complete passages or to random samples from a book.

The Flesch ratings of the papers in the June 1960 issue of this journal are: reading ease, 39 (difficult); human interest, 11 (mildly interesting). For the present paper: reading ease, 40 (difficult); human interest, 4 (dull) !

Flesch's system illustrates the trend in recent studies to move away from the purely numerical counts of structural features towards a more subtle approach to the complex

qualities involved in ease of reading. To discover objective methods of estimating these has been a key problem in the development of readability formulae. At the same time, an important consideration is that the method adopted should be quick and simple. If the technique is to be used extensively, a balance must be struck between ease of calculation and accuracy of measurement.

Here again we may ask: can we ever have a wholly objective standard for readability? The ease with which a passage is read is closely dependent on the reader's interest, on his reading skill and level of intelligence, and particularly on his motivation. These considerations apart, the technique can be a useful aid when we want to make a quick check on the vocabulary load of a school book or to test our personal impressions of the appropriateness of a text for a certain age-range. Flesch's little book also contains hints on how to write in a "readable" style, points which though not altogether acceptable to English teachers of traditional essay-writing, have quickly been grasped by advertising copy-writers and writers of popular newspapers and magazines.

Yet one must not overstate the importance of readability. Maximum readability is not the sole criterion of the excellence of a text-book; the book must also make sound sense and have some grace and economy of style. To quote Ernest Horn, one of the pioneers of frequency counts, "it is possible for a selection to be petty, unauthentic or utterly stupid, and still be acceptable according to the criteria that make up these formulae."

The Vocabulary of Text-books and Readers

A final type of frequency count is the analysis of the vocabulary content of text-books, and in particular of infant reading books. In such analyses, a count is made of the number of different words used and the number of times each word is repeated. In a primer for a child just beginning to learn to read, the number of words introduced should not be too great, and the words should be repeated frequently enough to enable the pupil to come to recognise them. In a series of graded readers, the introduction of new words should be combined with the repetition of words previously learned. Just how many words should be introduced at each stage and for each level of ability, and how many repetitions are needed, is a matter on which we still do not have nearly enough evidence: this is a vast field of research on its own. All that is claimed here is that the author should at least keep a check on what he is writing, and if he gives certain words frequent repetition, he should do so deliberately and not just by accident.

It should hardly be necessary to add that the intrinsic interest of a reader is as important as the controlled balance of its vocabulary. Preoccupation with vocabulary statistics can result in a dull book, but a good story in an infant reader will be all the more useful if there has been a skilful control of the vocabulary in it.

There have been many investigations of this kind: Section L of Dale and Reichert, *Bibliography of Vocabulary Studies* ("Vocabulary content of books") lists 302 references. An excellent example is Vernon's "Word counts of infant readers" in *Studies in Reading*, Volume I (1948). In this investigation seven reading books in common use in Glasgow schools in 1939-40 were analysed and compared with each other and with American reading vocabulary lists and with the speech vocabulary of Scottish children. The differences between the various readers in their presentation and repetition of words

were so great that they could not all have achieved the correct balance of vocabulary. The determination of the principles which should govern the vocabulary content of readers is not a simple matter: a valuable review of the issues involved is to be found in an earlier section of *Studies in Reading*, Volume I—Inglis' "The early stages of reading: a review of recent investigations" (in particular, pages 51-61).

The counting technique can be applied to many aspects of education other than the beginning stages of reading. The number combinations exercised in the examples set in Arithmetic text-books, the practice given in the technical vocabulary of mathematics or science or even history, the frequency of various kinds of errors commonly made by children as an indication of "accident zones" to which special attention should be given—these and many others are topics in which vague impressions are too often accepted without precise evidence. A good example of the application of vocabulary control in the teaching of foreign languages is Robson's study of "The vocabulary burden in the first year of French" (1934). The concept of the "vocabulary burden" or "vocabulary load"—that is, the size and level of difficulty of the vocabulary of a book or a curriculum—is a useful one for the teacher to have in mind in planning the work of a class. Teachers of English will find much of interest in Bagley's article in the *British Journal of Educational Psychology* (1937), which reviews many of the problems in this field.

Conclusion

In 1946 Fleming wrote in *Research and the Basic Curriculum:*

> "Teachers are becoming sufficiently skilful in their judgement of text-books to ask authors to furnish evidence of properly balanced vocabulary, a reasonable number of repetitions of each word, and a type of sentence structure as well as of contents and printing which is suited to the age of the pupil who is to use the books.... It is probable that the next decade will see a great improvement in the readability of text-books not only in English but in the content subjects, such as Arithmetic, History, Geography and Science." (page 30).

The decade has now passed, but it is the toothpaste manufacturers and not the educational publishers who quote the scientific (or pseudo-scientific?) bases of their products. Perhaps some day advertisements for school books will give precise details of the method of construction used and the experimental checks and classroom trials which have been carried out, instead of merely quoting sentences out of context from reviewers' opinions. Authors of text-books could at least show the way by including such details in a preface or in the teacher's edition of their books.

There is a danger in all this. In certain respects the techniques which have been described are ideally suited to academic research of the most ineffectual kind. They require enough labour to satisfy an examiner for a higher degree; they raise philosophical questions the discussion of which can be prolonged indefinitely; and when all else is exhausted, the researcher can play the old game of comparing other people's lists and noting the discrepancies. Naturally the agreement between lists is not perfect, and many an article has been written with the purpose of combining several other writers' lists into a super-list. One critic declared the only value of frequency counts to be "as a remedy for unemployment in pedagogical research."

However, doing research on word frequency does not involve surrendering one's better judgement to a ruthless rule of numbers. Good sense, insight and an impartial attitude are necessary all the time. Indeed, the fervent adherent anxious to present his labours in the best light is a greater danger than the sceptic who picks on one weak point in the argument in order to discredit the whole. At first the student of language may feel that to isolate words and tabulate their occurrence is mechanical work which will destroy the richness of inflexions and connotations of words. The numbers, however, are only a means of giving precision to intuitive methods which we all use. Rigorous analysis of words compels the research worker to reflect on the nature of language and helps to develop an insight into many aspects which were not previously realised.

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ATTITUDES OF CHILDREN AND ADOLESCENTS IN SCHOOL

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MANY teachers would like to see young people having longer full-time education. They feel that the general run of pupils leave school literate but still only half-educated. However, the success of raising the school leaving age seems likely to depend not only on there being available finance, buildings and teachers, but also on agreement as to what shall be done during the extra time and on the degree of willingness of the pupils to be at school doing it.

The questions of how far boys and girls are favourably or unfavourably inclined towards school at various ages, and of their attitude to various aspects of school have been studied in this and other countries, and this article reviews the methods used and the results. It will be clear that research of this kind confirms at certain points the conclusions drawn from studies of learning motivation considered in terms of needs and incentives and summarized in a previous article in this journal by Wall.

The concept of attitude

Attempts to measure attitudes date back to Thurstone's work in the United States in the late twenties; and this type of research seems to have entered educational institutions in the first place because in them, at least in higher educational institutions, were to be found large numbers of literate individuals able and willing to fill up forms. As a result a number of scales measuring attitudes towards various matters such as war, negroes, the movies, the Church, were constructed and administered to students in high schools and colleges. The study of attitudes soon became an established part of the study of education. The effects of education upon attitudes in various matters were studied. So were the attitudes of students towards various subjects of study and methods of teaching. A little later the attitudes of school pupils towards school as a whole began to receive attention.

An attitude is an arrangement of mental processes, a mental "set," an internal disposition or the way certain mental processes are organized in a person to make him ready to act in a particular way. A person is said to have an attitude towards an object if he regularly responds in a particular way to that object. The assumption is made that he is in a state of readiness to act in that way in regard to that object. A system of attitudes of this kind has advantages for the individual: it provides continuity in his world; he does not need to organize himself completely anew every time a given object is presented. He is continually organizing the way he sees the objects of his world and his wishes and feelings and knowledge about them into more or less lasting systems which will be ready, or rather will make him ready, to deal with those objects as the need arises.

Attitudes are built to last. In the words of Krech and Crutchfield, an attitude is " an enduring organization of motivational, emotional, perceptual and cognitive processes with respect to some aspect of the individual's world." Therefore, to know which way a person is ready to act is a help to knowing which way he is likely in fact to act. In an activity such as a piece of learning, attitude and motivation appear much the same thing, because an individual with a favourable attitude towards the activity in general is one who may easily be motivated or is already adequately motivated to undertake a particular piece of such activity. But unless the enduring underlying attitude is favourable to learning in that situation, say, there can be little effective positive motivation at any given time.

However, although attitudes are in general enduring, they can be changed, and indeed are changed gradually as the person's experience proceeds. The way he sees the objects of his world and his wishes, feelings, and knowledge about them can develop and change so that he is as ready as can be to cope with those objects fittingly at any time. The fact that most attitudes are resistant to change but nevertheless are capable of being changed is one of the chief reasons for studying them. We may also say that the formation of attitudes is one of the principal aims of education, though it is rarely given the attention it deserves.

Why pupils' attitudes to school are important

One reason for paying attention to pupils' attitudes towards school is that favourable attitudes should be encouraged so as to form a sound basis for future living. The home is the child's initial world. In it the mother and father play the chief roles in the formation of the child's " authority figures "; that is to say, that the behaviour of parents in the early years tends to lay down in the child's mind his basic ways of reacting to authority, or, better still, his attitudes to authority. The school is the first durable larger world into which the children must next emerge. The behaviour of the teachers then begins to colour considerably the child's earlier notions of authority and of himself in relation to it. If, says Oeser (1955), the mother, the father and the teacher " are experienced as benevolent, loving, security-giving and devoted to maintaining and increasing the child's conception of himself—his self-esteem or integrity—the child will grow up in good mental health, with an accepting yet independent attitude to society and its government."

As boys and girls gradually come to know and partake in the adult world beyond the school, the school is required to accept this and to help its pupils interpret and understand the nuances of authority in adult life and help each individual to progress from a children's conception of authority to a more independent conception. If attitudes of pupils as they get older are less favourable towards school because they perceive it as a child-centred institution we should ask ourselves whether this is what schools should be; or whether, in fact, the last years at school should not be a bridge or transition in the whole field of discipline from adult control to self-control. One thing is certain, adolescents will attempt to free themselves from dependence and tutelage, if necessary by revolt. It is certainly not impossible to avoid this revolt whilst ensuring that the transition contributes constructively to personal maturation. Teachers, for instance, can minimize adolescents' inferior status and treat them in certain respects as equals. They can exert control with

the minimum use of openly coercive methods. Such methods, although securing obedience, sometimes with impressive alacrity, may nevertheless lead to the rejection of the teacher and to the need for even more use of those methods. They are almost certain to lead to a rejection of the values and aims in the interest of which coercion is exercised. It may well be that a particular school in a neighbourhood where home life is in many cases not very good may seem to have no alternative to open coercion simply because negative attitudes to authority have been built up beforehand which are highly resistant to change. It seems, however, hardly likely that this condition would apply throughout the school; and in any case there is an obligation on the school to do something to readjust attitudes and to move from coercion towards a more integrative, mature relationship in pupils and staff.

A further reason for paying attention to the attitudes of children towards school is that attitude may be an important non-intellectual factor in the learning of school subjects and may condition the success of the teachers' efforts at motivation. Pupils have to be willing as well as able to learn. This point will be raised later in considering the results of some of the research.

Finally, adolescents' attitudes to school may be studied simply as a means of increasing knowledge of the process of adolescence, of the process of socialization, of which adolescence is the final and proving stage, and of age and sex differences in outlook.

How attitudes of schoolchildren and adolescents have been studied

When we speak of a person's attitude to something, we are usually making an inference from a whole series of acts or responses of his that we have observed concerning it. If we observe enough of his acts or responses we may find there is a consistency about them which indicates a probability that a certain response will recur in certain situations. Expressions of liking or disliking for things and people connected with school, or expressions of opinion about them are such responses, for instance, and they are readily observable.

There is, however, the question of validity. How far does what an individual says is his attitude in fact correspond to actual behaviour? Can we predict what he will do from what he says? Not a great deal seems to be known about this relation between verbal responses and action responses.

The argument of consistency appeals to common sense. Equally, however, common experience tends to contradict it. The result of at least one objective study raises serious doubts about it. Corey, for instance, took scores made on an attitude questionnaire about honesty in the classroom and compared them with actual cheating in the classroom and found that, highly reliable though the questionnaire was, the students' attitudes to cheating scored on it were in no way related to the extent to which they actually cheated when given the chance. On the other hand, Mitchell, using an attitude scale which distinguished between pupils according to whether their attitude towards school work was either that it should be a rigorous preparation for life or that it should be made as easy as possible, found that the two extremes differed considerably in their school work. The average " grade," i.e. mark, was found to be higher for the " rigorous " group. This was

taken to show, as Mitchell puts it, " that pupils either put their attitude into action or their actions produced the attitudes that were checked on the scale," and that either way this meant that the attitude scale in question did measure what was intended. It seems reasonable to suppose from these two contrasting results that verbal expressions of attitude are likely to be coloured by what the subject knows to be acceptable; his behaviour will differ to the degree that it is easy or difficult to follow accepted *mores* in action. It seems also likely that in highly emotionally charged areas (like " honesty " or " sexual morality") discrepancies between expressed attitudes and behaviour will be greater than in those not heavily sanctioned by social approval or disapproval.

The main methods used in studying attitudes have been questionnaire scales, interviews, examination of personal documents, ratings by other persons and projective tests. All of these methods have been used in research into school children's and adolescents' attitudes.

A questionnaire scale as used in this field is nearly always of either the Thurstone or the Likert type.

A Thurstone-type scale is produced in the following way. First, a large number of statements about the object of the attitude, e.g. school, are collected together. As far as possible they are short, varied, unambiguous, and between them express the whole range of favourable and unfavourable attitudes towards the object. These are then sorted by perhaps 10 to 20 judges to determine an agreed position for each statement on the continuum between extreme approval and extreme disapproval. The judges are preferably " expert " on the topic of the test, but it makes no difference what their own attitude is. As a result of this sorting a scale value representing the mean of its judged positions on the continuum can be assigned to each statement; those statements about which the judges largely disagree can be discarded; and the final selection of thirty or more items spread fairly evenly over the whole range can be made. The test lists these items randomly and asks the subject to signify which statements he agrees with. His score is the mean of the scale values of those statements.

The following are the first few items from a 30-item scale by Fitt. The scale values range from 0 to 10.5. The relevant values are given here, though they would not appear on the test itself.

I like school better than anything else. (0).
I feel happy at school. (1.8).
If I had my way I would never go to school. (10.3).
I like everything about school. (0.9).
I like some things at school but do not like others. (5.1).
I hate school more than anything else. (10.5).

A comparable scale for the American high school was produced by Remmers, Brandenburg and Gillespie.

A Likert-type scale is made by collecting statements about the object of the attitude, asking the subjects to signify for each statement whether they strongly approve, approve, are undecided, disapprove or strongly disapprove. Each response is then scored by alloting marks from 5 to 1 corresponding to those categories, and these scores are summed

for each individual. Then the degree of correspondence between the response to each item and the total scores is examined and those items which fail to discriminate are dropped. Sometimes, especially with children, only three response categories are given, as in the following items in a test by the present writer, in which the subject strikes out the alternatives not applicable.

Few / Most / Some } of the subjects we have are useful and interesting.

About half / Almost all / Only a few } of the teachers we have are friendly towards us.

For studies in education the two types of scales each have their advantages. The Thurstone-type is probably easier for younger or less literate children to complete because they have not to make so many fine verbal discriminations between their feelings on various issues. On the other hand the construction of one of these scales is a very long job. Efforts were made earlier on to overcome this difficulty by Remmers and Silance who developed a generalized Thurstone-type scale which could be used to measure attitudes to any school subject. They suggested further that a master scale could be devised to measure attitudes to almost anything. But measurements on one such scale were shown by Dunlap and Kroll to have little correlation with those on a more specific scale. Bateman, in a similar way but less expansively, constructed a scale that could be used to measure attitude towards any educational programme. It is possible to combine the Thurstone and Likert methods, retaining important advantages of each. This was done by Charlton, Stewart and Paffard in a study of students' attitudes in university education departments, and could just as well be done in a study of pupils' attitudes to school. Whatever the method of construction of scales, however, for children the verbal tasks involved need to be very simple indeed.

In view of what was suggested earlier—that verbal responses might be influenced by the subject's views as to socially acceptable replies—it is possible that a truer reflection of attitudes might be gained if questionnaires were answered anonymously.

This question has been examined by Corey. As part of the study mentioned earlier he studied the relationship between signed and unsigned questionnaire scales concerning dishonesty in written examinations. He found that the students were about as forthright in their expression when the questionnaires were signed as when they were not signed. Other enquiries have found the same thing. This is rather remarkable considering it was found that their actual behaviour varied so much from their professed attitude, anonymous or otherwise; and it underlines the problem of the validity of verbal tests of attitude.

Interviews, especially of the freer type, as distinct from orally administered questionnaires, have not been so much used in attitude studies. Had they been more extensively used the criticism made by Krech, for example, that attitude testers have been busy

measuring things that are not there, would perhaps have less justification. In a questionnaire the investigator has no means of knowing if any particular response is a truthful one, and, even if it is, he still has not much idea of how this response is related to the enduring dynamic system or attitude underlying it, or even whether the respondent has in fact any attitude at all on the matter. In an interview the investigator is in a better position to detect untruthfulness in responses, and the attitude the responses are related to may be revealed indirectly or unconsciously in the context. At least in the non-directed interview the investigator may be able to see whether what he would measure is in fact there. But interviewing, particularly of the non-directive kind, and processing the data require more time and skill than constructing and administering questionnaires; and in any case often the subjects are not available for the length of time that such interviewing takes. A full account of a non-directive or clinical-type interviewing programme is given by Roethlisberger and Dickson in *Management and the Worker*, in which they report the research done at the Hawthorne plant of the Western Electric Company.

Outwardly, these interviews appear to be little more than conversations; they seem quite harmless, even pleasant, to those being interviewed. Even the more structured type of interview, which may come practically very close to an orally-administered questionnaire, seems to be more stimulating than a form to fill up. Perhaps it is simply because the person is singled out and addressed personally. Among children and adolescents the sense of finality in committing one's views to writing is probably quite appreciable. Also, for many of them writing and form-filling may be unattractive and difficult. They may occasionally adopt a method of disposing of questions in a questionnaire which is quick and painless for them but which provides nothing of use to the investigator. It is, therefore, surprising that more use has not been made of the interview method in studying attitudes of children and adolescents.

Interviews of a more structured kind have been used in such studies as the one reported in *Youth tell their Story* by Bell, in which the general conditions and attitudes of young people in Maryland were investigated. In such studies the comments or opinions expressed are, of course, concerning what the interviewers rather than the respondents think is important, and this may mean that a good deal of relevant material remains undisclosed. Rather less controlled inquiries were made, by interviews and other means, in a London evening institute and reported by Jordan and Fisher as an impressionistic but lively and recognizable " self-portrait of youth." This portrait makes up for any lack of scientific vigour by its wealth of insights.

Two instances may be given in which non-structured interviews, of the " Management and the Worker " kind, have been used with school pupils under conditions of careful control. In James and Tenen's experiment to see how far children's attitudes changed in favour of people of other races as a result of personal contact with them, the attitudes of a group of secondary modern pupils were studied. The pupils were interviewed four times at intervals of six weeks. In the interval between the second and third interviews two African teachers taught them. The interview material, when analysed, showed that there were no significant changes in attitude expressed between the first and second interviews. Neither were there changes in attitude expressed between the third and fourth interviews. But between the interviews before the children had been taught

by the African teachers and the interviews after, a notable change had taken place. The attitudes expressed were more favourable, not only towards negroes in particular, but also to a lesser extent towards foreigners in general. It is here that we see one of the objects of studying attitudes with scientific methods. With proper measurement of attitudes we can test the effectiveness of means calculated to change them.

The present writer has used a similar method of interview in a study of the attitudes of fifteen-year-old secondary modern school pupils towards school and teachers, the results of which will be considered later in this article.

Against the advantage that these non-structured interviews may provide material additional to what the investigator set out to look for, must be set the corresponding disadvantage that a great deal of additional material is gathered which may have nothing to offer at all. On the whole, however, such material still has to be gathered and processed in case it has something to suggest.

Similar advantages and disadvantages affect the use of personal documents such as essays, diaries and letters. By these means, however, material can be gathered in schools much more easily and quickly than by interview. For pupils at school, essays at least are all in the day's work. The method has been used, for instance, in part of Tenenbaum's study in which children were asked to write down anonymously what they would say to a friend who asked them what they thought about school. Jersild based a study of the characteristics of teachers on written retrospective reports by adults, compositions by children, interviews, and some records of children's conversations. Strang studied adolescents' views in freely-written compositions on the subject: "How it feels to be growing up."

There are, of course, the obvious limitations that not all subjects can command the relatively high level of introspection and self-expression necessary if we are to get at the truth and that some at least will put up a deliberate smoke screen, often with such skill that it is difficult to detect any insincerity.

Projective techniques, too, have been sometimes employed. These consist usually in starting the child off on some theme—by a picture shown to him, by an open-ended film strip or by an unfinished story—and then letting him continue in the direction he chooses and observing how he ends up. Similar to this is the method used in a study of children's attitudes towards discipline as related to their social and economic status by Dolger and Ginandes. Children of differing background were asked to write a composition based on a story which was read to them in class. The story was about Jimmy, who always broke up Tommy's games. Each child was then asked to write what he would do about Jimmy if he were Tommy. Here again such writings are nothing out of the ordinary for schoolchildren; though some of them might find writing difficult or even impossible, and any study of such a kind would have to take account of this fact. This study established, as might be expected, that children from homes of relatively low social, educational and economic level seemed more inclined to punish a culprit and to avenge his misdeeds than did children from homes of higher status.

The treatment of the material obtained in the study just mentioned was fairly easy because the area in which the responses were to be made was relatively specific. Difficulties arise with this and similar methods if there are no limitations at all. For example,

a sentence-completion test was used by Bene to study the differences in attitudes between pupils of grammar schools and of secondary modern schools. Sentences were begun with only a word or two and left for the pupil to finish. A rather elaborate method of coding the responses had to be devised, one symbol representing the attitude judged by the investigator to be expressed and another standing for the object towards which the attitude appeared to be expressed. By this means it was possible to show that the grammar school boys were more ambitious and had less positive and more negative attitudes towards their environment than had the secondary modern school boys.

Ambiguous words were used as the basis of a projective-type test in an early study by Shales which compared the " mind-set " of urban and of rural children. The difficulty of finding sufficient words with two meanings both relevant to the purposes of the test must have limited the use of this method.

The remaining method to be considered in research into attitudes in schools is that of ranking items in a test. Pupils of the then secondary schools were asked by Pritchard to rank school subjects in order of their liking for them and a similar means was used with elementary school pupils by J. J. Shakespeare. Inferences were then made from the rankings and from the reasons given for them. This form of inquiry has been used also by Michael, Herrold and Cryan in an attempt to find students' attitudes towards certain factors which the investigators considered to be important in promoting classroom enjoyment and towards various procedures employed by teachers. Such ranking tests are, in fact, questionnaires consisting of one large question, such as: " What is the relative importance of the given items? " or " What is their relative desirability ? ", as the case may be.

Validity of attitude tests

An important aspect of attitude study which has received some attention is the question of the validity of teachers' assessments of pupils' attitudes, since these, in the absence of more objective criteria based upon behaviour, seem likely to give a yardstick against which the validity of a test, questionnaire or scale may be estimated. Here again, as with verbal responses themselves, we encounter difficulties. Teachers' assessments of attitudes are themselves liable to similar distorting influences as are children's verbal expression of their own attitudes; and it seems likely that both the reliability and the validity of their judgments will vary according to the social and emotional values attached to the attitude in question and according to the objectivity with which it can be observed in action.

Burt compared the reliability of tests of various kinds and of teachers' assessments, using the method of analysis of variance. Among other things he showed that for mental characteristics concerned in the everyday work of the classroom, such as " industry " or attainments in the 3 Rs, the assessments of competent teachers appeared to be quite reliable and even more reliable than standardized tests. He also showed that in the case of most character-qualities the reliability of teachers' assessments, though never very high (except for " industry ") was higher than that of a single interview or that of any psychological test then in use.

Reliability of assessment is not the same as validity however. Teachers' assessments were found to have no validity in rating the maturity of high school pupils in a study by Remmers and Martin. Teachers agreed very well in their ratings. To that extent they were reliable. But they rated juniors as being more mature than seniors on 11 out of 13 traits. The investigators concluded that on the reasonable assumption that maturity is partly, at least, a function of age, teachers did not rate these traits validly. They suggested that teachers' *mores*, or as we might put it " teachers' ways ", seemed on the whole less offended against by juniors than by seniors, and that therefore items which on other evidence should have favoured the seniors did not do so.

Again, in a study of the validity of teachers' ratings of adolescents' adjustment and aspirations, Ausübel, Schiff and Zeleny examined the relation between teachers' ratings and various other self-report, objective, and projective measures of the same characteristic. The average of ratings by five teachers had a high split-half reliability; but there was no significant correlation between them and the other measures. Again, we must question the validity of the teachers' judgments as well as the validity of the self-ratings. Either each is validly measuring something different or one or the other or both are an invalid measure of an underlying disposition.

This general question of validity seems to be the outstanding problem of attitude study in education. All the current means of estimating underlying attitudes are inevitably indirect. They can only be based upon verbal report or interpreted observation, each of which is liable to be coloured, consciously or otherwise, by the circumstances. We have, too, the problem of criteria of validity of any measure we may devise, for example in attempting to assess attitudes to school. It may be possible to see how " known " individuals or groups measure on a given test with a reasonable degree of reliability. But how are they " known "? Clearly, we cannot at this stage rely on teachers' ratings; these have been seen to lack validity in terms of other measures and to be subjectively coloured.

The clinching argument for the existence of an attitude would be its emergence in behaviour. It may be possible to see to what extent actual behaviour is as predicted by the test. If it is possible to do this, the prediction may seem to be confirmed, as it was with the " rigorous " or " easy " attitudes of students, or it may be denied as in the case of cheating. On the other hand it may not be possible to ascertain one way or the other simply because attitude is only one factor at work in a fuller situation such as attainment or behaviour at school. For example, we know that the correlation between attitude and attainment is low, at least at certain levels; this has been shown in different ways by Jordan and by Arvidson; and it may well be due to other attitudes preponderating in a given situation or to the fact that intelligence is more important in school work than any but extremely favourable or unfavourable attitudes. So, too, the actual situation may determine a response. If, say, everyone else seems to be cheating, it is conceivably quite hard to remain indifferent and get the lowest marks simply through not cheating—even though one's attitude is genuinely that cheating is wrong. At all events there are hardly any attitude tests in the educational field, it seems which can claim to be of even moderate validity on the grounds that they are correct in predicting behaviour. This seems to be because usually the behaviour evoked is the complex outcome of ability,

personality and the particular situation, as well as of the kinds of attitude the subject willingly expresses. We may put it in another way and say that in any individual there are likely to be a variety of attitudes and motivations some of which may be potentially or actually in conflict. Actual behaviour will tend to be determined by broad dominant attitudes or motivations, modified and sometimes heavily modified, by other attitudes called into play in specific situations. Moreover, closely similar behaviour may be provoked in different individuals by attitudes which are widely different in their content.

In the present state of development of the theory of the subject we have on the whole to fall back on the face value of attitude tests, and ask whether a question of this or that kind is in fact relevant to the attitude we wish to explore. Apart from this we can compare the results on the test with those on a test which explores the same or nearly the same attitude, if one is available. This other test will, of course, itself have lacked a direct criterion of validity; and any interpretation of our results must be made with caution.

There remains the question of whether, even if we do reach the particular attitude by verbal means, the actual behaviour that may occur is related to that attitude. There is a clue in the cheating experiment as to why there may be no relation. We know what we ought to do, but we do not always do it. We may say we shall do it, or we may wish to do it, or even usually do it; yet we may still not do it under conditions of stress. Interpretation of results of attitude tests has, therefore, to take this consideration into account. We can at least say that measurements of attitude, made with attention to objectivity and based upon as wide as possible a sample of each subject's verbal responses, are likely to have more reliability and validity—particularly concerning groups—than are the more or less subjective judgments of individual teachers.

Attitudes towards school

We now review some conclusions drawn from studies made of pupils' attitudes to lessons, to teachers, and to school as a whole.

Pritchard, by means of his rank order test, studied the relative popularity of secondary (now grammar) school subjects among over 8,000 pupils. Each pupil had a list of subjects and, after crossing out the ones he did not take, had to number the subjects in the order in which he liked them, giving reasons for the first and last choices. This was done anonymously. Pritchard concluded from the results that the school work boys and girls liked best was of the kind in which there was self-activity, or in which they could prove things and discuss and argue. They felt the need for variety, and wanted everything linked up with everyday life. Above all, they looked for the human interest in everything, since they felt they had left behind the child's world and had found new interests in the world of adults. One of their strongest desires, he suggested, was to be treated as if they were mature.

J. J. Shakespeare undertook a rather similar study in the higher classes of what were then elementary schools and are now secondary modern, and found that generally the subjects which permitted bodily activity were the more popular. At about 11-plus there seemed some devotion to subjects where noticeable results could be obtained, and it was evident that achievement in a subject had an influence on its popularity. Later, the

development of an interest in what lay beyond school brought with it the idea of usefulness of subjects which influenced their popularity.

Tschechtelin, Hipskind and Remmers constructed an attitude test for measuring the attitudes of some elementary school children in America toward their teachers. The major aspects of the teacher's personality were, as the investigators put it, " through logical analysis subsumed under seven general areas." That is, they were aspects chosen by the investigators and not arising directly from empirical data. This might be regarded as a weakness, since important areas of judgment on which the subjects' attitudes are partly based, may be overlooked.

The seven aspects chosen were:

1. Liking for the teacher;
2. Ability to explain;
3. Kindliness, friendliness and understanding;
4. Fairness in marking;
5. Keeping order with the children;
6. Amount of work required;
7. Liking for lessons.

Two tests were devised, one of which was administered to over 1,300 children from Grades IV to VII, that is from 9 to 13 years old. The results showed that the average attitude of children towards their teachers was substantially favourable, and rather more so with rural than with city children. No consistent trend was found in regard to age or grade; and there was no appreciable correlation found between attitudes as measured and intelligence test scores, nor between attitude and achievement. As the scores of boys and girls do not appear to be separated it is not possible to observe any differences between them. If they had been separated it might also have been possible to see a trend with age. It is quite possible, say, for a trend on the part of girls to be cancelled out or masked by a trend the other way or no trend on the part of boys, or vice versa, and for no trend to be discernible either way if the scores are mixed.

Jersild, in a study of characteristics of teachers, was partly concerned with adult recollections of teachers. While we may not find very much that is relevant to our purpose in this part of the work, since adults' appraisals differ from children's, as Jersild himself shows, there are some interesting conclusions drawn from children's accounts of their teachers in both elementary and high schools. Here the major headings under which teachers are characterized appear to be provided by the actual data, and not predetermined by the investigator.

These headings were:

1. Human qualities as a person;
2. Physical appearance, grooming, voice;
3. Characteristics as a disciplinarian or director of the class;
4. Participation in activities; providing gifts or entertainment;
5. Performance as a teacher; teaching;
6. Miscellaneous and general.

Children mentioned discipline more negatively, in relation to teachers they disliked, than otherwise. Teachers, in their teaching, were mentioned especially in relation to teachers who were liked; and there was an increase with age of children, in emphasis on this item. Physical appearance of teachers was mentioned more frequently by girls than by boys.

In a study of relationships between 11th and 12th grade students (16-17-year-olds) and their teachers, Michael, Herrold and Cryan asked students to rank a number of matters concerning their enjoyment of classes. The results showed that both boys and girls within each of several schools ranked the items concerned in the same order. There was no difference in ranking as between one school and another or one age or ability level and another.

It is difficult to say precisely what value to attach to the particular list of items ranked in this way, since the items appear from the report to be simply what the investigators considered important. However, the important thing found was that the ranking of them did not vary. In brief, the list as ranked is as follows:

1. Teacher's method of teaching;
2. Teacher's personality;
3. Confidence in teacher's knowledge of subject;
4. Good marks;
5. Short assignments;
6. No special emphasis on discipline.

Eells, in 1938, collected and classified unguided written responses to the questions: What do you like best, and what least, about your school? His purpose in doing so, however, was to devise a scale which could be used for evaluating schools by their pupils, as part of a wider study of educational facilities in America. The scale was to measure schools, not pupils. The present writer has not been able to find a report of its use. It seems possible that though judgments about school made by pupils may reveal something about the school, they are likely to reveal a good deal more about the pupils. The method shown of classifying pupils' comments about schools is of some interest, however, and in that the categories are thrown up by the actual data, they are more likely to be on the mark than they otherwise would be. The study shows the frame of reference of the American pupil, as far as *written* responses are capable of disclosing it.

Tenenbaum, using partly an attitude questionnaire and partly freely written material also studied elementary school pupils in America, and found that the girls expressed more favourable attitudes towards school than the boys. They appeared to regard school more seriously, and seemed to think more of the school's value as a preparation for life. Teachers appeared more popular than the school situation itself, although among the group disliking school, the teachers were the most frequently mentioned cause of dislike. Girls appeared to like their teachers more than boys did. Children rated by teachers as problems expressed markedly more unfavourable attitudes than those of the total group.

Tenenbaum found that children's attitude to school as measured was not highly correlated with other variables, namely, intelligence, achievement in school work, conduct and marks. He concluded, therefore, in regard to achievement, that the theory that failure is always associated with resentment was not borne out. On the other hand,

Drummond, using a simplified type of attitude questionnaire in which the statements to be checked took the form of a discussion around certain points between a group of boys and girls, seemed to find the attitude to school on the part of backward adolescent rather luke-warm. She suggested this showed that more attention might be given to them.

Stacey found little difference between girls and boys, and none between town and country children, in attitude to school. Attitude measures remained stable over a year's interval except for a change among 12-year-olds, which might have been due to the waning of the interest in new surroundings and new subjects which they had shown in their first year at secondary school.

Although not approaching the subject with attitude tests of the kind we have been considering, Oeser and Emery have provided further light on the way children see the school and the teachers. In a rural community in Australia a " School Ideology " test was given, on the lines suggested by Bavelas. The conclusions of their study are limited by the fact that they were drawn from results in the only school in the community studied. Nevertheless, they are illuminating in a way that conclusions drawn from larger-scale attitude-test studies cannot match. It was found, as might be supposed, that children saw the teacher as possessing the greatest potency in the school situation. Their behaviour was directed principally towards the teacher and not towards the school work itself. The relative potency of the teacher was seen as greater by the children in the lower school grades than by those in the higher. Older children were a little more clearly aware that behind the school's demands stand the parents and other adults. There seemed, too, a slight though insignificent tendency for school work to be less attractive to senior children. Even so, there did not seem to be very great differences with increasing age.

In the city study by Oeser and Hammond it was found that in spite of the authoritarian character of the classroom, children did not reject school or the teacher, though they did not favour situations in which they were closely controlled by the teacher.

Fitt describes the construction of a Thurstone-type attitude test-scale concerning children's attitude to school, and gives the results of using it with over 1,200 children of several age, social and economic, and school-type groups in New Zealand. At all levels girls showed a more favourable attitude to school than boys. This was most marked in the lower primary school. Secondary school pupils, boys and girls alike, did not like school as well as primary school pupils. Brighter pupils liked school better than duller ones, and this was especially the case with boys. Children from the more favoured areas tended to like school more than the others, again more so in the case of boys; but here it was found difficult to distinguish the relative effects of ability from the environmental factors connected with it.

In a further study of this last question, Coster showed that responses of pupils of different income levels to an attitude questionnaire were more likely to vary on items referring to the subject's relations with teachers and other pupils than on items requiring objective appraisal of the school or the school work.

Arvidson, in a study of the factors determining school achievement of first-year secondary pupils, found evidence that home background was by far the most important single non-intellectual factor. It was much more important than attitude to school as such, although Arvidson noted an instability of attitude as measured at that stage. He showed that home background had almost as much to do with school success as intelligence itself and sometimes more. This confirms what was found earlier by a number of other investigators that the direct correlation between attitude and school achievement is low, at any rate among younger children corresponding to those in the early years of the secondary school. It suggests that given a minimum basic willingness to learn the required material, attitude to school in itself does not greatly influence school achievement at that stage unless possibly the attitude is strongly adverse. Given the ability and a favourable home, pre-adolescent and young adolescent pupils will succeed at school whether they like school or not and in most cases liking or disliking for school is not very strong nor very stable. This may well be because the material concerned may be acquired, in the circumstances, almost as much through what goes on outside school as through what they learn inside.

It seems likely, however, that, especially as the material to be learned gets more complex and structured, attitudes to school, which include attitudes to learning in school, assume greater importance as determiners of success. Also, as time goes on, such attitudes will presumably become more suitable.

The present writer carried out a small intensive study of pupils of a Central London secondary modern school, in which 68 fifteen-year-old pupils were interviewed at length and the entire school tested with both Likert and Thurstone-type attitude scales. From this it appeared that girls were not more favourable towards school than boys at the 4th year stage, at the end of which they were to leave. The tests showed that in the school studied, girls were more favourable than boys to begin with, but that at the end of two years there was nothing to choose between the sexes. Towards the end of school life the position showed signs of being reversed. On the whole, throughout the school the pupils showed favourable attitudes, though the range was fairly wide; that is, in general the pupils appeared willing and co-operative. On the other hand, the downward trend, if it were to continue, might make the girls, at least, decidedly unwilling to stay on at school much longer on the same footing. The interviews showed that boys and girls alike at fifteen years old were concerned as to whether the teaching given them was interesting, useful and effective; and much of it they considered was not. They were concerned that they should be properly kept in order; but, especially in the girls' case, they appreciated some teachers' being friendly to them and treating them as in certain respects their equals. They liked competent teachers. They complained of punishments, naturally, and of having to do things they were no good at. On balance, school and teachers were commented on rather more unfavourably than otherwise, but this was probably to be expected because the interviews were an opportunity to air complaints. These ways of looking at things, however, seem not only more sensible, but even rather more adult, than no doubt a lot of people would have expected. It must be remembered, of course, that these findings refer to one school only.

There are still some questions on which this type of research might throw useful light One is, how important is attitude to school as compared, say, with intelligence as a factor in learning in the later stages of the secondary modern school? It will be recalled that this study in the London secondary modern school suggested that fifteen-year-old girls were slightly less favourably inclined generally to school than boys. This contradicts the findings of work in other countries. Does the same apply elsewhere in cities in this country? What relation is there between attitude to school and all-round level of maturity? Who are against school—the more mature adolescents or the less? What is the relative effectiveness of some of the ways that might be tried of improving attitudes to school? If an interview to some extent lifted the morale of the worker, as it was said to do in the Hawthorne experiment, by providing an opportunity for him to get things off his chest, can the morale of the adolescents at school be raised if a skilled and sympathetic adult listens to and perhaps discusses with them their complaints and personal problems? Does the school have much to offer to adolescents with problems? Hemming's study of letters received by a girls' paper shows that many girls need more help than they get at home and school and elsewhere. Do boys remain more free of problems and retain their interest in school work longer than girls because their adolescence is in general somewhat slower? Are attitudes to school, or at any rate to formal learning, improved after adolescents have had some experience of going out to work?

Such studies as we have reviewed point to some conclusions. It seems reasonable to suggest that ordinary adolescents at school must be made to feel that they really are being taught; that there are many interesting things to do; that they are controlled and disciplined in a way that clearly recognises the status that they wish to have, and often do have, in the outside world. They need to feel that their work in school has a real bearing on what they will do when they leave; that it is suited to them personally.

Discipline, school work and status are inter-related. If there is no real interest or relevance in the work, coercion is needed if the work is to get done; this, however, underlines the pupils' inferior status, and will lead them to reject school and its demands in favour of other interests. Such difficulties can be avoided, and, without doubt, in some schools are avoided. There can be a choice of courses, especially of a more vocational kind. There can be more democratic forms of control, not necessarily democratic in the institutional sense, implying a school council form of self-government, but in terms of an atmosphere in which young persons' opinions and feelings count. At one end of the scale this will be a matter perhaps of providing a choice of courses which in some ways follow the pupils' inclinations or ambitions; at the other end of the scale it would be simply a question of, as the pupils' are apt to put it, teachers speaking nicely to them and being considerate for their feelings.

If the period of full-time education is to be extended successfully, however, for the general run of adolescents, it will have to be in a setting as little like a world of children as possible; since by all the signs adolescents who now leave school at fifteen do not much think of themselves as children, nor do they think *like* children; and in many ways in fact many of them are not children.

Generally, in the studies discussed, investigators have noted that older pupils seem less favourably inclined towards school than younger ones. Most people would probably say this was inevitable. But why should it be? If we provide good conditions in school for social and personal maturing, which are what ordinary young people need, it follows that they will experience the satisfaction and maintain the favourable attitudes on which willingness and co-operation depend. If their attitudes to school deteriorate generally, it follows that those good conditions are absent from school. What some of those conditions are, such studies as these can help to tell us.

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HOMES AND SCHOOLS: SOCIAL DETERMINANTS OF EDUCABILITY

by JEAN FLOUD, *Reader in the Sociology of Education, University of London*
and A. H. HALSEY, *Senior Lecturer in Sociology, University of Birmingham*

SCHOOLS are selective institutions; this is only another way of saying that some children do better than others. But do the schools select socially, as well as academically or intellectually? If we ignore chance features of family environment and personal life history, do children of equal (presumed or measured) ability have equal opportunity of access to schools of various types, and equal chances of success in them, regardless of their social origins? If not—if schools are not freely open to all, and if their pupils' chances of success are systemically related to the religious, ethnic, or social-class affiliation of their families—what are the factors at work?

These are questions of relatively recent origin. They had little meaning, indeed, before the rise in the inter-war period of the notion of equality of educational opportunity; and they took on practical relevance only after the Second World War, when the supply of highly-trained man-power in the advanced industrial countries began to be recognisably inadequate. Under the dual impetus of the egalitarian desire to secure every child's birthright to an education suited to his age, ability and aptitude, and of the 'search for talent' which has reached a new pitch of intensity post-Sputnik in the United States, the desirability of reducing all differences of educational performance or success to differences of natural endowment, has gained wide-spread acceptance as a touchstone of policy. The tacit objective has become to produce, as it were, a natural order of inequality, unmarred by factitious and irrelevant social differences.[1]

From the point of view of the social investigator, this raises many problems both of technique and principle. Educational opportunity must be defined and measured; its social distribution must be assessed and related to the social distribution of 'ability', likewise suitably defined and measured. Criteria of educational performance must be set up, and they must be capable of comparison both as between school and school, and over time. Finally, the full range of social factors at work (e.g. socio-economic status, father's education, mother's occupation before marriage, family size, etc.) must be identified, and the manner of their influence on performance examined. The investigation of these problems evidently calls on a wide range of techniques, from those of the demographer to those of the social psychologist.

There has now accumulated an extensive literature on the social differences underlying selection in education. As has already been indicated, these differences may be regional, ethnic or religious, as well as social-class in character. However, the discussion here will be limited to the latter, with particular reference to what is known from social investigations of the problem in England and the United States.

It is worth noting, to begin with, that the structure of education has little influence on the extent of the problem. This is not surprising. In an industrial society, education is inevitably increasingly involved with the dynamics of the class structure and with the economy. We are familiar with the tightening bond between occupation and social class, and between education and occupation; and whatever the characteristic mode of educational organisation, it seems inevitable that schools, colleges, and universities should perform selective functions which, to a greater or lesser extent, tend to overlay, or possibly impede, their pedagogical purposes[2].

Thus, in England, the educational system is overtly selective. Not only is there an important private sector, but within the public (grant earning) system promotion from primary to secondary school still involves, over most of the country, selection by competitive examination for admission to grammar and technical schools. In America, on the other hand, a free system of primary and secondary schools is now of long standing. Yet social class inequalities in type and amount of schooling have excited social investigators in both countries since the 1920's.

In England, the obvious first task for sociologists was to measure social-class inequalities of access to the selective secondary schools and to their counterparts in the independent system. Distinguished work was carried out in the tradition of 'political arithmetic' by Professor Lancelot Hogben and his associates at the London School of Economics in the 1930's[3]. They established the use of clear measuring devices; 'ability-opportunity' ratios, and 'class chances' of education, derived from the social and intellectual composition of educational institutions related to that of the population from which they are recruited. After 1945, when secondary school places were made free of fees and open to competition, it became necessary to explain the persistence of inequalities under conditions of free competition, and to ask what are the obstacles to 'perfect' representation of the population at large within selective schools and universities[4]. Studies of the class-conditioning of educational chances now are supplemented by research into its influence on educational performance and vocational aspiration. Study of social selection *for* education is extended by study of social selection *through* education.

Thus, since the end of the Second World War, sociologists have shown marked interest in documenting more thoroughly the extent of social selection for education, and in penetrating the processes by which it goes on in the schools, and the manner of their connection in this respect with the wider social structure[5]. Investigations have been carried out on both sides of the Atlantic into social selection within the school; that is, into the influence of children's social-class position, variously defined, on achievement and deportment in school—on the relations of children with their classmates and with their teachers; on their attitudes towards discipline and the rewards and punishments they attract to themselves[6]. A picture emerges in both countries of working-class children, on average, doing less well than others academically, being rated by teachers lower on personality characteristics associated with academic attainment, expressing less concern themselves about their progress in school, participating less in extra-curricular activities, leaving school at an earlier age and aiming less high vocationally.

The problem of educability falls somewhere between psychology and sociology, and the division of labour between them in this field of work is unclear, and likely to be

blurred still further with every step forward which is made. Psychologists have been mainly responsible for the systematic accumulation of knowledge of the relations to educational performance of two major aspects of social environment, namely socio-economic status and family size[7]. But these relations have still to be elucidated. As McClelland points out[8], the question of the linearity of the relationship of intelligence tests scores to school performance has not been studied as it deserves. He asks pertinently, "Let us admit that morons cannot do good school work, but what evidence is there that intelligence is not a threshold type of variable; that once a person has a certain minimal level of intelligence, his performance beyond that point is uncorrelated with his ability ?", and he urges, "the desirability of plotting carefully the relationship of ability-test scores to performance criteria *over the entire range*, in order to check for acceleration, deceleration, or other curvilinear relationships." Moreover, despite the well-established influence of socio-economic status on the achievement in school of pupils matched for measured intelligence (I.Q.) no thorough study has been undertaken of the relations between these three variables throughout the whole range of each.

The meaning of the relationship with family size is likewise unclear. It is a well-established fact that educational performance is negatively correlated with family size at all social levels (i.e. within as well as between the social classes); but there have been few attempts to discover whether and under what circumstances a large family may be a causal factor, in the sense that it produces of itself an unfavourable educative environment for children, or is simply an index of a complex of educationally relevant attitudes and values on the part of the parents[9].

For their part, sociologists have been principally concerned with the nature of 'environment', by which they have meant in the main, 'home background', i.e. features of family and neighbourhood environment, including the peer groups of children and adolescents[10]. These have been investigated with increasing refinement. There has been a shift of emphasis since 1945, away from the study of gross material factors such as poverty, malnutrition and overcrowding, to more subtle features of home background affecting response to learning in general as well as to particular types of schooling. Class differences in attitudes towards children's education and future occupations, the significance of the educational level reached by parents, or of the social grading of the mother's occupation before marriage, are being explored; as well as, much more fundamentally, the differences in emotional training and linguistic habit and development characteristic of children from different social backgrounds[11]. But the study of the school as a factor in educability has been neglected; little has been done to explore in any detail the explicit and implicit demands of life in school, to which pupils are disposed to respond selectively in terms of their social experience outside its walls.

The problem of educability has in fact been approached in somewhat one-sided fashion by sociologists, although the influence of the social anthropologists has offered something of a corrective[12]. That the interaction of homes and schools is the key to educability has always been evident to anthropologists in cases where the gulf between them is wide, as when formal education is introduced into the tribal life of pre-literate peoples. Although detailed studies of culture-contact and social change through edu-

cation are regrettably rare, the influence of the anthropological approach is strong in the studies of the American Negro from which stemmed, until recently, the most illuminating work on social-class differences in the drive towards educational success. Moreover, the most promising penetration of social-class factors in educability has come from attempts by social anthropologists and social psychologists to analyse child-rearing practices from the point of view of their adaptive value in competitive 'middle-class' school systems, and to study motivation in learning as influenced by the balance of power and interaction characteristic of different kinds of family 'culture'[13].

All this has done much to deepen our understanding of educational and institutional factors in the learning situation. But much work remains to be done, and especially on the institutional factors referred to. It is a fact that the educational significance of features of 'home background' has not been fully exploited, largely because there exists no sociology of the school to which they can be related.

In principle, we may say that there are two main sources of social influences on the educational process; there are those deriving from the family environment, and general background of teachers and pupils (and, in the case of teachers, also from their professional needs and habits); and there are those deriving from the social organisation, formal and informal, of schools, colleges and universities. The child may come to school ill-equipped for or hostile to learning under any educational regime; but for the most part his educability depends as much on the assumptions, values and aims personified in the teacher and embodied in the school organisation into which he is supposed to assimilate himself, as on those he brings with him from his home.

This is nowhere clearer than in the case of the so-called 'early-leavers' from the English Grammar school and the Scottish Secondary schools, or the 'drop-out' from the American High school, which we cite by way of illustration. The social, as distinct from the academic, character of this process of selection—which culminates but does not begin at the threshold of advanced courses at the top of the school in England and Scotland, or at the point of college entry in the United States—is well established[14]. In the English Grammar school, with its selected population and rather specific educational programme, it takes a particularly clear form. Changes in the rank order of entrants are systematically related to their social-class origin, to such effect that the proportion of children in the top one-third of the performance hierarchy who are drawn from working-class homes falls steadily, from about two-thirds at the beginning to around one-third at the end of the seven-year school course[15].

American experience, essentially similar, but less well defined in the context of a non-selective school system, makes it clear that this process of social as distinct from academic selection, is something that goes on with varying degrees of intensity and thoroughness in all kinds of school. The problem is not merely to document its existence but to understand its working. This involves the study, not merely of the 'home background' of pupils, but of the school as a relatively self-contained social system, purposeful in a formal sense, rife with its own conflicts, exerting its own pressures and making its own demands, formal and informal, tacit and explicit, on pupils who respond selectively in terms of their wider social experience.

We hope to discuss in a subsequent article the study of the social system of the school, and to show that until we understand schools at least as well as we are now beginning to understand 'home background' we shall remain ignorant of many powerful 'hidden characteristics' of the learning situation.

(*In preparing this article, the authors have drawn heavily on* THE SOCIOLOGY OF EDUCATION. A TREND REPORT AND BIBLIOGRAPHY *prepared by them for* CURRENT SOCIOLOGY, *Vol. VII*, 3. *Basil Blackwell*, 1958.)

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THE DESIGN, CONSTRUCTION AND USE OF STANDARDISED TESTS - Part 1

by D. A. PIDGEON

I. What tests measure

IN everyday life, we often observe people behaving in certain situations or on certain tasks and make an estimate of their performance. We may say, as a result of our observations, " That man is intelligent," or " That boy has mechanical ability," or again " This child's attainment is well above average." Such statements are liable to be highly subjective opinions and at best will be valid only within the experience of the person making them. They are of little value if we wish to take the combined opinion of a number of observers. But if a number of selected tasks can be so ordered that we are able to observe objectively how people perform them in a standardised situation, we can, as a result, put those people into an order of merit according to their respective performances. We call such a collection of selected tasks given in a standardised situation a test, and its main purpose is to assist us in the assessment of human behaviour.

A test, then, attempts to measure behaviour, and we can legitimately define what a test measures only in terms of the sort of behaviour required to complete it. For example a child responding to a set of carefully selected arithmetical problems that have been brought together to form a standardised test can be said to be demonstrating arithmetical ability. Ability, however, is a general term and it may be used to cover other commonly used expressions such as ' attainment ' or ' aptitude.' It is desirable therefore, to assign specific meanings to such words, using ' ability ' to cover fairly broad types of performance, 'attainment' to cover behaviour that has resulted from specific teaching and ' aptitudes ' for performances that, so far as we can ascertain, have been learned without specific teaching and which we can use to predict future behaviour. Into this classification we can fit various kinds of tests, such as ' general ability ' or ' intelligence ' tests of attainment in reading or arithmetic and tests of mechanical 'aptitude' used to predict likely success in technical courses.

Apart from the different meanings attached in everyday usage to the words ability, attainment and aptitude, there is a considerable overlap in the actual content of the three types of test themselves. It is difficult to distinguish clearly between what has been formally taught and what has been learned incidentally. Similar items often appear in tests bearing different names. The simplest classification is therefore perhaps one defined in terms of the purpose for which the test is required.

If we wish to measure school accomplishment, we can devise a suitable test and describe what is measured as attainment. Thus an attainment test is, in a sense, a descriptive statement about what children can do within a specified field of work and at a given time. For any one child it gives an indication of his level of achievement and this can be related to the performances of a specified group of children on which the test was

standardised. As a result of observing the behaviour of a child on an attainment test we can say that compared with a standard population his performance was above, below or just at the average; alternatively we can assign the child a score on an arbitrarily devised scale which relates his performance to that of a standard population.

Coming within this same category are ' diagnostic ' tests. These also measure accomplishment but instead of relating the results to the performances of other children, the specific behaviour of an individual is related to the known body of knowledge of the subject tested. For example, by observing which particular sums a child or class has answered incorrectly in a diagnostic test of arithmetic, a teacher is provided with useful information on which to base his future teaching in arithmetic.

Quite often a test is required to predict future behaviour, and it is convenient to call tests designed for this purpose aptitude tests. It is important to remember, however, that any test only measures *present* behaviour, although it is often possible, from this, to make inferences about future learning. Straightforward tests of attainment have been shown to be useful in predicting a child's performance on a later occasion, but the prediction is likely to be specific to the subject tested. If, on the other hand, we want a measure of aptitude for learning, say, in a general academic course of education, then the test must cover a far wider range of behaviour than that usually associated with a single attainment test. Such a test, covering a wide range of behaviour, and employing verbal, numerical and perhaps abstract reasoning items is sometimes called an intelligence test, although, if the behaviour covered by it is restricted to the kinds of learning which schools aim to produce, it is more appropriately labelled a scholastic aptitude test.

Human behaviour is exceedingly complex and the most elaborately designed and carefully constructed test can, of course, only attempt to measure a small sample of it. It is important, therefore, to realise that, reliable as it may be, the information available from an educational test is limited, and care should be taken not to draw inferences that go beyond what can reasonably be deduced from an examination of the behaviour covered by the test.

Standardised tests can render a valuable service to teachers if competently used. The results they give can be misinterpreted—sometimes dangerously so—if their function and purpose are not properly understood.

II. How tests are constructed

As a preliminary to describing how the modern standardised test is constructed it would not be inappropriate to give briefly the main points of difference between such a test and traditional types of examination paper. These differences are, of course, reflected in the actual process of construction of the standardised test, but the reasons for them should be known if the value of tests is to be fully appreciated.

In the first place, the relatively few questions requiring somewhat lengthy responses of the examination paper are replaced in the test by a fairly large number of items which for the most part need only a short one or two word answer. This means that the range of possible questions that *could* be asked is more adequately and deliberately sampled and the risk of taking a biassed selection is practically eliminated. Second in importance,

perhaps, is the emphasis upon objective scoring in the test, which reduces drastically any unfairness that might arise from the subjective judgement of the marker. This objectivity is often achieved by the use of 'multiple choice' responses, although in many tests, especially tests of attainment in English, what are known as 'creative responses' are nowadays employed. Provided sufficient care is taken in their construction and adequate guides supplied to markers, even complete sentences or short paragraphs can be demanded as responses and the subjective influence reduced to a minimum. The net result of both these differences—more items and objective scoring—is an increase in the reliability of the measure obtained. Reliability is here used to denote the consistency with which children are likely to be put in the same order if given the test on different occasions. It is clearly important, if the results are to be of value, for the reliability to be relatively high—little reliance can be placed upon a result if it is known that on a subsequent occasion a child's score is likely to be quite different.

Most of the other points of dissimilarity are concerned with the actual construction. The items appearing in a good test will all have been thoroughly tried out before being selected for inclusion, and in addition, as is described below, by giving the test to a large representative sample of children, the possible ranges of performance on it are carefully established. With the usual type of examination paper, comparatively little time is required to prepare it, but because of the subjective element in the marking and lack of knowledge about its overall behaviour, considerable skill and labour are required to assess a child's performance: with the standardised test all the time and skill goes into its construction and the scoring is relatively easy. A note of caution should be added to the foregoing statement; the relative ease with which a test may be scored should not detract from the importance to be attached to the careful interpretation of the results. This is a point to which we will return later.

Details of the construction of a particular test will depend upon the purpose it is intended to serve, but for most tests, a similar sort of plan is adopted although the concentration of work may differ at different stages. Let us suppose that it is desired to prepare an ability test for eleven year old children. First the number of items it is to contain must be decided upon. There is of course no number of questions which is right for all purposes and the number chosen depends upon the testing time available and upon the degree of reliability. The longer the test the more reliable it is likely to be. Experience shows that the average eleven year old child will complete about 100 items in a test of this kind in about 45 minutes without being unduly fatigued. It is necessary to devise at least four times the number of items required for the final version of the test, and in devising the items the skilled test constructor will be guided by his previous experience. Without such experience it would probably be necessary to double the number of original items.

The next stage is to select from the total number of items the 100 most suitable and efficient for the test. This is not an arbitrary business; the selection is made not by the test constructor but by the children themselves. The 400 items are arranged in drafts each usually containing about 75, and administered to a group of between 120 and 150 children chosen to be representative in age range and ability of the children for whom the test is finally intended. These drafts are given without time limits and it is usual to restrict

the administration to one draft per day. When all the items have been attempted by all the children, the drafts are marked and each item is then submitted to a detailed analysis. First the level of difficulty of each item is ascertained by calculating the percentages of children getting it correct. Items that are too difficult (less than 25% correct responses) or too easy (more than 85% correct responses) are discarded, for it is clear that they cannot usefully serve the main purpose of a good item in a test of this kind, which is to discriminate most effectively between those who demonstrate the ability being measured and those who do not. The next stage of the analysis is to determine how effectively the remaining items are achieving this discrimination. A number of different techniques have been developed for this purpose but they are all based upon a measure of the agreement between success or failure on the item in question, and success or failure on the test as a whole. For an item to discriminate effectively, those who possess the ability being measured must be able to get it right, while those who do not possess it should get it wrong. This important point can best be demonstrated by considering the hypothetical situation arising from a test of 100 *perfectly* discriminating items. If the facility, or difficulty level, of each item was exactly 50%, then we would find exactly 50% of the children getting every item correct—that is, scoring 100—and the other 50% getting every item wrong—that is, scoring 0. Of course, perfectly discriminating items are not found in actual practice, but the ' efficiency level ' of the items in a well-constructed test may be very high indeed.**

The 100 items eventually selected are then submitted to a further check. If the item is a question in which the child has to choose one of a number of given responses, an analysis of wrong answers is made. If the same wrong answer is chosen by too many children it must be eliminated; elimination is particularly necessary if this wrong answer is picked by children who do well on the test as a whole. Tests sometimes employ ' open ended ' items in which the child has to supply a word, phrase or sentence. It is then necessary to analyse all the different answers given, both right and wrong. If too many children give the same wrong answer the question is probably ambiguous and is discarded or re-worded.

The next stage is to assemble the chosen suitable items into a second draft to be tried out again on another representative sample of children. On this occasion it is usual to impose a predetermined time limit in the light of previous experience and the purposes for which the test has been constructed. The number of children failing to finish is noted so that a change can be made if necessary. After the drafts have been marked, the complete item analysis is repeated in order to confirm the previous results. Errors in the figures obtained may occur, due simply to variations arising from the use of different samples. If a bad item is revealed by this second analysis it must of course be replaced.

The main purpose, however, of this second try-out is to check upon the *validity* of the test, that is, the test constructor needs to be satisfied that the test really is measuring what he wants it to measure. To do this, the scores on the new test can be checked against teachers' judgments of the ability being measured. Another method more usual

**Incidentally this example demonstrates very well how the distribution of " raw " (i.e. actual) scores on a test may be structured by the selection of items of differing difficulty and efficiency levels. In the hypothetical example quoted the distribution is, of course, perfectly dichotomous. In actual practice if a test is required to discriminate effectively over the whole range of ability, a rectangular distribution of raw scores is aimed at and very often achieved.

these days is to administer to the same group of children another test of the same kind which has been extensively used and proved to be useful for the purpose for which it was constructed. The results obtained on both the new and the established test are then compared.

Finally, when all necessary revisions have been carried out, and the test constructor is satisfied, the new test is printed. It can now be said that the half-way state has been reached, for there remains the all-important task of *standardising* it. For this purpose the test is given to a large representative group of children of the required age range. This group is chosen so that it is as typical as possible of all children and takes account of such things as sex, intelligence, kind of school attended and whether they live in the town or country. Precise instructions for the administration of the test will, of course, have been worked out previously, for it is important that the conditions under which it is taken should be as uniform as possible on all occasions.

The purpose of the standardisation is to discover precisely how children perform on the test and then to relate the scores they obtain to an agreed scale. The average of the actual or 'raw' scores is calculated and also how the scores are dispersed about the average. In addition, since there is generally a variation in the average scores obtained by children differing by only a few months in age, it is necessary to determine the rate of increase in score per month of age. The raw scores themselves cannot of course be used for comparative purposes, since the mean or average raw score and the spread of scores will vary from one test to another, so that a child, for example, who is average in two tests may well obtain different raw scores. There are a number of different scales to which the raw scores can be transformed, as we shall see later. The process of standardisation, which usually involves the preparation of a conversion table for transforming the raw scores to those of the agreed scale, involves a fair amount of computation, but the result of it means that the performance of any child on a test may be assessed by comparing him with a representative sample of children.

III. Methods of expressing test scores.

Reference was made in the last section to the fact that raw scores are inadequate if the performances of children on different tests are to be compared. They convey nothing in themselves, for unless we are also given some more information about the test, such as the known mean and spread of scores, any single raw score is completely meaningless. To score 45 on a test might be the highest possible score, the lowest or just average. However, if the average score obtained on all tests by a fully representative sample of children was made, equivalent to 100, then if a child subsequently obtained this score we should need no further information to tell us that his performance was average.

But we do not want merely the average; we also need to select a unit so that distances from the average can be marked off. The unit most usually employed in test measurement is the standard deviation, and it is calculated by determining the root mean square of the deviations of score from their average. The value of the standard deviation of

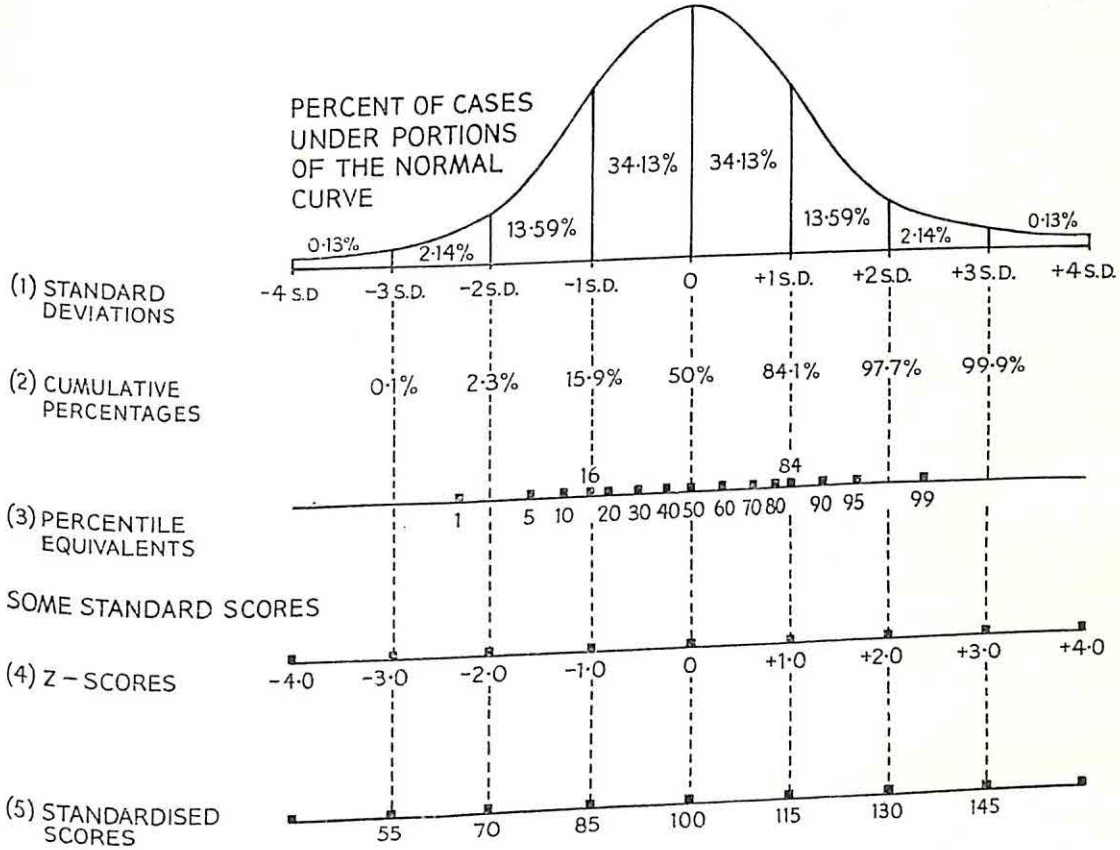
raw scores will, of course, vary from test to test, but, just as it is possible to transform the raw score mean to a scale having an agreed number (such as 100) for the mean, so the raw score standard deviation can be transformed to a scale having an agreed value. The numbers actually allotted on these scales to the mean and standard deviation are quite arbitrarily determined and many scales of this kind, each possessing distinctive features, have been devised. It is, however, increasingly becoming the practice in this country to adopt one particular scale—that in which the mean is 100 and the S.D. (standard deviation) is 15—and this is described in more detail below.

It is necessary first to say a few words about some other types of scale that are sometimes used—namely the mental age, the I.Q. and the percentile rank. The use of the concept of mental age dates back to the first individual intelligence test devised by Binet in 1905. In this test and the subsequent revisions of it the mental age indicates the chronological age at which the test performance is appropriate. Thus a child of 10 may be credited with a mental age (M.A.) of 8 if his performance is appropriate to the average 8 year old. Scores expressed in this way, however, may be misleading if it is assumed that they have some absolute value. It would clearly be an unwarranted assumption that the child quoted above possesses the same mental ability, for example, as another child, also with a M.A. of 8, but with a chronological age of 6! This same concept is equally inappropriate when applied to tests of attainment. Because two children have the same reading age it does not necessarily follow that they require the same educational treatment.

In an attempt to take into account the chronological age of children tested, the mental ratio or I.Q. was introduced. In this the mental age is divided by the chronological age and to eliminate fractions the result multiplied by 100. Thus the 10 year old child quoted above has an I.Q. of 80 while the 6 year old has an I.Q. of 133. However, problems of interpretation still arise. A child of 5 with a M.A. of 6 has an I.Q. of 120; a child of 10 with a M.A. of 12 also has an I.Q. of 120; but the first child is advanced by one year of mental age and the second by two years. Clearly the use of the I.Q. has not eliminated the age factor and indeed an I.Q. should not be used unless it is accompanied by a statement of the age at which it was attained.

Further difficulties in the use of the M.A. and I.Q. occur with older children and adults. The calculation of adult I.Q's. must depend upon the fixing of an adult mental age, but the age at which test scores cease to rise is essentially a function of the test itself, and whereas the highest M.A. on one test may be 12, on another it may reach 20 or 25 years. Also to fix arbitrarily the adult mental age at any point is a contradiction in terms, since by definition the mental age is the equivalent of a mean score for an actual chronological age.

These limitations upon the use of mental ages and I.Q's. have led to their gradual abandonment and replacement by a form of scale in which the performance of any child is compared, not with children of different ages, but with other children of exactly the same age. In order, however, to appreciate scales constructed in this way, it is necessary to consider the properties of what is known as the normal curve of distribution. (See Figure following.)



It was pointed out in Section II that the distribution of raw scores on a test depends entirely on how the test was constructed. It is, however, a relatively easy matter, and for a number of reasons, desirable, to ' normalise ' any distribution, that is, to adjust the raw scores so that they take up the sort of distribution illustrated in the diagram. Any point on the base line represents a particular score and the height of the curve at that point indicates the number of children awarded that score. Thus a large number of children gain scores at or about the mid-point or average of the distribution, and as the extremes of the range of scores are approached the number of individuals concerned decreases. Vertical lines can be erected from the base line at the mean of the distribution and at unit intervals above and below this point. It will be remembered that the unit adopted is the standard deviation, so that lines are drawn on the diagram to represent one standard deviation above the mean, two standard deviations above the mean, and so on, and similarly for units of standard deviation below the mean.

It is now that the properties of the normal curve become clear, because we know the exact percentage of children falling within the limits defined by the vertical lines. It will be seen from the diagram, for example, that about 34% of children whose test

scores conform to this distribution will have a score that lies between the mean and a score equivalent to the mean plus one standard deviation. The same number of children will have scores that lie between the mean and minus one S.D.; 95.4% will have scores between plus and minus twice the standard deviation; 99.7% will have scores between plus and minus 3 S.D., and only a negligible proportion will have scores lying outside these limits.

Row 2 of the diagram gives these percentages expressed cumulatively from the lower to the upper extreme of the range of scores. Row 3 gives the ' percentile equivalents ' or ' percentile ranks '—the other type of scale that was mentioned earlier. The relationship between these two rows can be seen from an inspection of the diagram. For example, an individual whose score on a test was one S.D. below the mean is awarded a percentile rank of 16, and this indicates that of the total group concerned 16% will be found to have scores below this level. Similarly an individual whose score is one S.D. above the mean is at the 84th percentile—that is, 84% of the group will have scores below this level.

The method of percentile ranks can, of course, be applied to any form of distribution. If the distribution of test scores is somewhat flattened or skewed to one side because the test was too easy or too difficult for the group taking it, the percentile rank corresponding to one S.D. above the mean, for example, may well be different from the figure quoted above. Also, it should be noted from the diagram, the intervals between ranks are not equivalent all along the scale. In terms of units of test score the difference between the 95th and 99th percentiles is greater than the difference between the 40th and the 50th.

We may now return to what are known as ' standard score ' scales. It should be clear now that by equating the average score on a test to zero and adopting the standard deviation of the test scores as a basic unit, the raw scores from any test may be expressed with reference to any scale that is found convenient. For example, if the average score on a test is 48 and the standard deviation is 12, then a score of 48 would be made zero, a score of 36 would be -1, a score of 66 would be $+1\frac{1}{2}$ and so on. Just as with percentile ranks, this system, known as z scores (row 4), can be adopted for a distribution of any shape. Negative numbers are a nuisance, however, and for convenience the mean score is often equated to a large whole number. This is done in the standardised scores set out in row 5. These are obtained by normalising the raw score distribution and equating the mean to 100 and the standard deviation to 15. There is no particular significance in these figures—they were chosen merely because the intelligence quotients derived from adaptations of the original Binet test had a mean of 100 and a standard deviation approximating to 15. Using this scale, a child who obtained a standardised score of 115 would be one S.D. above the mean, that is, he did better than 84% of the population on which the test was standardised.

As was explained in the previous section, it is customary in this country to incorporate a system of age allowances in the process of standardisation. This, however, is not an essential feature of this method of expressing test scores. In other words this method may be used to indicate the relative levels of performance of a specific age group without adjusting for differences of age within it—though for most purposes an age allowance is essential and is now incorporated in the norms of most published standardised tests.

IV. The interpretation of test scores

It is always the aim of a good teacher to understand his pupils—their capabilities, their deficiences and their limitations. The judicious use of the standardised test will assist in that understanding by providing the teacher with a reliable means of assessing his pupils' abilities and attainments and of diagnosing their weaknesses. The interpretation of test results, however, requires much care and thought and it is important that the scores obtained should not be merely accepted at their face value and endowed with a meaning they do not possess.

The first point to be considered in assessing a child's performance on a test is the extent to which the score obtained is subject to error. Most measurements, even of physical characteristics, are liable to error. For example, a weighing machine may be badly constructed so that it tends to give inconsistent results when used on different occasions; again, although the mechanism is faultless it may be poorly calibrated so that the readings obtained are still incorrect; and again, although there may be no error from these sources, it may nevertheless be used incorrectly. All these three sources of error—faulty construction, inadequate calibration and improper use—apply to educational and psychological tests, with perhaps an additional source of error arising from variations in performance of the children themselves.

So far as tests are concerned it is difficult, if not impossible, to distinguish between errors arising from variability in children's performances and those arising from faults in the construction of the test. No test is perfect and the fluctuations in the performances of children are well known to every teacher. Thus the score derived from any test is subject to error, and clearly, then, it would be a distinct advantage if the size of this error could be ascertained. Unfortunately there is no practical way of determining this for an individual, but the margin of error that should be allowed for on the scores from a particular test can be determined. If the hypothetical situation could be considered in which the same test was given an infinite number of times to a child, after due allowance had been made for practice effect, the obtained scores would be found to cluster into a group. In these circumstances it is not unreasonable to assume that the average of these scores is characteristic of the child's performance on the test and what is wanted, therefore, is an estimate of the extent to which the score derived from a single administration is likely to differ from this average or 'true' score. In practice this estimate is obtained from the measurement of the reliability of the test, and this, it will be remembered, is the consistency with which the same scores are likely to be reproduced on a second occasion, or, in other words, the extent to which observed scores are likely to differ from 'true' scores. Tests differ in the extent to which a single administration provides a good estimate of a pupil's 'true' score.

The most convenient statistic for measuring this margin of error is what is known as the standard error of measurement (SE_m), and it is usually quoted in the manuals to good standardised tests. Approximately two-thirds of all scores obtained for a test will be within ± 1 SE_m of their 'true' scores and approximately 95% within ± 2 SE_m. For example, if a test has a standard error of measurement of 2.5 points (on a scale of standardised scores), then approximately 95% of the observed scores will lie within ± 5

points of their ' true ' score. Another way of saying the same thing is that, with this test, the ' true ' scores of 19 out of 20 children taking it lie within ± 5 points of their obtained scores. In only one case in 20 is the ' true ' score likely to be outside these limits.

So far, only the errors arising from the test itself and the variability in performance of children on it have been considered. A few words must now be said about other sources of error. Errors arising from a faulty calibration of the weighing machine considered earlier have their counterpart in the errors which may arise from an inadequate standardisation of a test. The description given in Section II showed how important this process is, and if the sample chosen for this purpose is too small or not fully representative, errors of considerable magnitude can occur. Again, the manual to a good test will give details of the standardisation and if these are omitted or are clearly inadequate the test should be used with caution. Most of the tests for teachers constructed in recent years in this country attempt to provide norms based upon a fully representative ' national ' sample, so that the performances of children in any one school can be compared with other children in the country as a whole. A truly ' national ' sample is, however, rarely achieved and strictly speaking comparisons should only be made with the standardisation sample quoted. In certain circumstances, for example, a test may be standardised locally (e.g. on children in one city or county), and the norms may well differ from what would be expected in the whole country.

Finally, errors may arise from faulty administration and marking. It cannot be over-stressed that all tests should be given precisely according to the instructions laid down in the manual. Children's performances may be improved if additional words of explanation are given or more time allowed, but comparisons with the established norms will then be no longer valid. Also, despite the relative ease with which an ' objective ' test can be marked, it is surprising how many errors can arise from this source. It is important, therefore, that an independent check be made on all markings.

This foregoing description of the possible sources of error in a test score may appear to be formidable. It is, however, a possible warning against the too literal acceptance of a score as a number with a fixed meaning. Provided tests are administered and marked correctly, and due account taken of the known errors of measurement, the results they give can be of great value.

For a class as a whole they enable a teacher to assess reliably the level of attainment reached and to make comparisons with other classes in the same school, with similar groups in previous years and with other children of the same age in other areas. They are of value too in assessing individual differences and needs, although in this respect the test results must always be matched against the rest of the teacher's knowledge of the child, and any discrepancies that occur elucidated by further investigation. Careful interpretation will enable the teacher of a large class to direct his attention swiftly towards those children most in need of assistance. Finally, of course, the periodic use of standardised tests, by enabling the teacher to express the assessment of his pupils in meaningful form, can be invaluable for passing on relevant information for school records.

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THE TEACHING OF ENGLISH IN SECONDARY SCHOOLS

by SHEILA M. BATE

Introduction

"THE teaching of the mother tongue is notoriously ineffective; the incessant strictures on the illiteracy of children and adults are paralleled by the bewilderment of teachers how to overcome it." So wrote M. M. Lewis in 1952. Since then the situation has changed little but rather more publicity has been given to it. The purpose of this article is to consider some of the different approaches to English teaching, to examine some of the reasons for the current dissatisfaction with the general standard of literacy and to consider such objective evidence as we have.

"Illiteracy" is a word which tends to be coloured in its meaning by the prejudice of those who use it. Strictly used, it means a total inability to read and write. In most rigorous research literature it is taken to apply to a condition in which no useful functional skills in reading and writing exist. As Lewis points out, a distinction must be made between absolute literacy and functional literacy; the standards regarded as functional are becoming steadily more rigorous. In the Crowther Report it is used in the functional sense to mean an undefined but presumably marked deficiency in language and communication skills, and to mean deficiency in "all that is conjured by the term 'Humanities'." Thus the words literate or illiterate appear to imply education, or lack of it, in arts subjects. The terms used, "humanities," "deficiency," etc., are not strictly defined at all and appear to refer to fluid, often inconsistent, notions meaningful only in a specific frame of reference. It should also be pointed out that while we may provisionally accept the second of the two Crowther senses because of its relevance to English studies, we cannot take for granted that a knowledge of the humanities is a guarantee of literacy in any of its senses.

One reason for the present problematic situation is probably the variety of notions, mostly ill-defined, about the aims of English teaching. The mechanical skills have almost always been regarded as essential and teaching of spelling, punctuation and the like has often been taken as a matter of course. Literary knowledge has frequently been regarded as the hall-mark of a liberal education, and has been emphasised with varying degrees of insistence. The reports of the Inspectorate in 1906, 1910 and 1924 stressed the importance of literature in schools. The 1921 report of the Board of Education had much to say on the importance of literature in imparting a consciousness of their nationality to children. The Hadow Report of 1926 referred to the value of literature as an interpretation of life, an idea elaborated by Niblet when he says that the aim of teaching literature is to bring to consciousness what is involved in being human. In the Spens Report, 1938, three objectives were recommended to teachers of English: the facilitation of written and oral communication; use of these powers of communication to develop social responsibility in the child; and, ideally, the teaching of literature as a heritage. This last point is cautiously

made and in fact it is recognised that it may not be possible for literature to be taught. In recent years there has been an increasing preoccupation with language, and the fact that the language of literature and the language of the child may be very different things has become officially recognised.

The official reports were influenced by the views of experienced men like Ballard and Hartog, and in turn they had wide influence on teaching practice. The present position seems to be that several different approaches to the teaching of English exist, sometimes within the same school. One approach which is fast becoming obsolete is that which requires all aspects of language to be taught by means of formal academic exercises. Pupils were practised constantly in the whole gamut of formal grammar, in defining isolated words, learning the technical names of rhetorical devices, and similar devices designed to convey a body of information after the pattern of other subjects. In continuous writing the children were exhorted to imitate a style, often the anachronistic mannerisms of Charles Lamb. I. A. Gordon comments that in his experience this approach to writing tends to produce work of a humourless insincerity. In literature the children would be asked to scan, to paraphrase or to analyse Latinisms. The whole emphasis of this kind of teaching was analytic. The revolt, fostered by men like Ballard and Gordon, has been gradual but decisive.

A second approach current in some schools has filtered through from the works of John Dewey and the other 'child-centred' educationists. The theory was that the child should work at what he wished under the strength of his own motivation. In practice this is not easily achieved in schools with large classes. What may happen is that the structure and aims of the school remain unaltered but a superficial attempt is made to introduce the child-centred way into the classrooms in the hope of winning the child's interest. Thus, an English text-book may contain passages about children of the pupils' own age or people in a town like theirs. The comprehension and vocabulary questions appear under the heading "Quiz-Time" or some such euphemism.

Nevertheless, there was a genuine and considerable modification of the language syllabus; as a result of the steady building up of opinion and the infiltration of views from the United States, English is no longer regarded as a body of facts about grammar, literature, composition and the like, but as the study and practice of the essential skills of reading, writing, speaking and listening, dignified by the name of communication skills, and having as ultimate aim the development of powers of expression in the child. These are skills which may be developed in varying degrees according to the aims of a particular course and the age, ability and motivation of the children. There is as yet insufficient research by means of which we may grade English courses according to level of difficulty and the needs of children at different ages; but evidence is available to help us in this task.

Motivation

In many schools a dichotomy between language and literature still exists. 'Literature' remains the study of a few sacrosanct classics which can be guaranteed not to appeal to the majority of the class, because they are far removed from the interests of the pupils and quite foreign to their linguistic habits. Many grammar schools today no longer enter

pupils for 'O' level Literature papers because of the narrow syllabuses prescribed by many examining boards. Throughout this article literature will be equated with the reading of books, not necessarily classics, and no dichotomy will be preserved between the different skills of reading, comprehension, writing, etc., since these are simply means to self-expression, not ends in themselves.

The prime problem in the teaching of English is one of motivation. The work of A. J. Jenkinson and W. J. Scott has made this position clear. Jenkinson published in 1940 the results of his questionnaire survey of the free-time reading habits of some 3,000 children in the old senior and secondary schools. Scott, in 1947, published in New Zealand the results of his four-year survey into the reading, film and radio tastes of nearly 4,000 high school boys and girls. The general conclusion is that none of these media offers a barrier to enjoyment so long as the material is congenial and the manner of presentation appropriate to the child's level. There is a study by A. R. Williams on the magazine reading of secondary school children which makes comparison with the earlier findings of Jenkinson and of M. Stewart on the leisure activities of school children.

Number of Magazines (i.e. "Bloods" and "Comics") read per week by Secondary School Children, 1930-1940, 1946-1947, 1950

Average number read per child		12+		13+		14+		15+	
		SM	GR	SM	GR	SM	GR	SM	GR
Jenkinson	BOYS	4.2	3.7	4.0	3.0	4.0	2.0	–	0.8
Stewart	BOYS	2.5	2.7	2.5	2.7	1.7	1.8	–	0.7
Williams	BOYS	2.5	2.3	2.5	2.4	2.4	1.9	2.1	1.0
Jenkinson	GIRLS	2.7	2.0	3.3	2.0	4.2	1.3	–	0.6
Stewart	GIRLS	1.8	1.7	1.5	1.3	0.8	0.7	–	0.7
Williams	GIRLS	2.2	1.5	2.1	1.6	1.9	1.5	1.4	0.8
Percentage Reading None									
Jenkinson	BOYS	5.7	11.8	7.3	17.5	10.5	34.4	–	49.1
Stewart	BOYS	10	15	12	20	35	42	–	84
Williams	BOYS	5	21	23	30	14	33	25	55
Jenkinson	GIRLS	16.5	14.0	6.4	14.8	7.5	34.1	–	66
Stewart	GIRLS	14	19	20	31	49	55	–	92
Williams	GIRLS	11	35	15	45	25	43	38	69

(By permission of Methuen)

It is important to realise that "Bloods" and "Comics" are not by any means wholly bad and that within this general class there is a wide variety of reading matter. There are now, as before the war, a number of serious weeklies and monthlies for children and adolescents as well as considerable reading matter of a good level in the children's pages of some daily newspapers. Many of the strictures of *The Seduction of the Innocent* are, however, true; and perhaps truer now than twenty or thirty years ago.

As a result of his survey, Williams concludes that "schools and educationists are not making the fullest use of opportunities for introducing the adolescent to worthwhile reading matter and less exacting forms of literature. A great reserve of reading energy remains untapped which could be used to raise the cultural level of children who are approaching the age at which their formal education is about to cease."

Some at least of the problem lies in the presentation and format. The illustrated paper is more attractive than the bound book; the book illustrated in vivid colour than that which is unillustrated; even Alice found books without conversation and pictures dull; and many book-loving children find descriptions boring.

Beyond all this there is, however, a sociological problem. Hoggart points out in his book, *The Uses of Literacy*, that there is in certain social groups often a hostility and contempt for the prescriptions of the academic elite. The hostility is propagated by the use of the linguistic conventions "them" and "us," which reflect social divisions that cannot be lightly removed. The attitudes learned in early childhood at home prove difficult to eradicate; the attempts of a teacher of adolescents to help his pupils develop values contrary to or decried by the social groups to which they belong are likely to be arduous and may be foredoomed to failure unless he combines outstanding teaching technique with an attractive personality. One thing that a teacher in these circumstances can do is to try to build on existing interests, which usually tend to sex, violence and rhythmic music. In such a process of development the teacher needs to use every medium to hand, and in English often has greater success with more active methods than reading, although reading has an essential part and a valuable one, once motivation is aroused. There have been many American studies on the specific problem of reading motivation, and some of the suggestions are being practised over here. Mersand, in *How to English the Unwilling*, makes the following conservative suggestions: the use of anthologies for different levels of abilities to meet the specific needs of fast and slow learners; the teaching of classics by making them contemporary human documents; and the use of audio-visual aids. Elizabeth Rose, in *Literature in the Junior High School*, suggests that teachers try every means to make children aware of books, by holding book fairs, reinforcing book ownership, encouraging free reading and playing on the children's interests.

Himmelweit's three-year study demonstrates some of the effects of home television watching on reading motivation. Her main conclusions include the following points:

Those children who spend a lot of time watching television naturally read less. Books suffer most; interest in reading comics simply drops from being unusually great to being normal. After a few years, book-reading returns to its original level but loss of comic reading remains. Therefore, she concludes, the proportion of book-reading to comic-reading by viewers increases.

In the interim period, the loss in book-reading is strongest among boys and among children of average intelligence, all those who read little to start with and can ill afford the loss.

Television can, however, extend the range of non-fiction interests, especially among the duller adolescents who most need it.

There is no evidence that television watching changes children's interests in fiction reading on the whole, but those who view may be stimulated to read the books dramatised on television, depending on the type of book and the way in which it is presented.

It is important to remember when interpreting this evidence that much of it is based on the *borrowing* of books by children; but borrowing is in itself no evidence of reading.

In the Modern Schools at least, the main problem is that of arousing sufficient motivation to remedy individual deficiencies in the communication skills; the attempt to propagate a literary tradition is largely anachronistic in this setting. As far back as 1922, C. H. Judd and G. T. Boswell demonstrated publicly what is obvious to every teacher, that enormous differences exist in the speed, accuracy, perception and progress of individual reading habits. Wide differences exist within one streamed grammar school class. Four-fifths of the school population do not attend grammar school classes so that the problem of coping with their individual needs is enormous. An American study by J. R. Squire offers four methods of dealing with this situation: (*a*) to teach one section of the class at a time, (*b*) to introduce a project in which children are given tasks according to their capabilities, (*c*) to assign graded reading work to groups according to difficulty, (*d*) to find some central motivation which will stimulate everybody to read and express himself at his own level. Clearly, all these proposals are fraught with difficulty and depend supremely on the relation of the teacher with the class, which depends on the personalities involved, the traditions within the school, the socio-economic area and the size of the class. Research can provide no simple answer to problems like these; each teacher has ultimately to evolve his own compromise.

Critical thinking

The findings of research can, however, make things easier for the teacher by presenting new ideas and examining old ones objectively. At the present time educationists have the task of assessing the merits of the primary aims of English teaching today and examining the techniques used to foster them. The primary aims seem to be: to develop the power of critical thinking in the child and to develop and encourage the child's powers of expression. J. H. Bens, in his article, "Teaching Literature in the world of Mickie Spillane," suggests that the primary goal of literature should be critical thinking. This, though it would not be accepted by all teachers of English as the primary goal, is clearly very necessary since, when he leaves school, the child will not only be exposed to every conceivable hidden persuader in the commercial world but will be called on to form a political opinion and perhaps to serve on a jury. Jepson, Stebbing and Thouless, in their books on thinking, warn against many of the pitfalls of argument; as they stand, however, these are suitable largely only for sixth form work. What is needed is a graded approach to the techniques of argument and discussion. Dorothy Bagley points out that reasoning

about words should not begin until children are ready for it—probably around the age of fourteen. A beginning, in the realm of formal logic, has been made by E. H. Miller in America. He conducted an experiment with children of sixteen which involved the use of twenty-nine different types of logical fallacy. He found that the most difficult fallacy to detect was arguing in a circle and the fallacy of the undistributed middle term the easiest. He proposed as a result of this that the reasoning processes be studied and age and grade norms be established as they have been for arithmetic and reading. Such work should be reserved for the last years at school, along with the review of formal grammar where this is given.

Seely has said that " the formal review of grammar should be placed at the end of a cumulative learning programme " when " the principles and usages to be formally organised have, for the most part, been practised and understood by the pupils for some time." Gordon maintains that clause analysis has real value as it is a test of the pupil's ability to grasp the mechanisms of his own language. This view is endorsed by the majority of the Examining Boards for ' O ' Level G.C.E. There is no evidence, however, that a knowledge of grammar helps to improve usage, or assists children to understand literature or to learn foreign languages—all claims that have been made for it. The method of analysing sentences diagrammatically teaches pupils nothing about how to use language. Bargahan and Stewart have shown that no transfer results from learning to diagram sentences. Macauley did an empirical study in Scotland in which he found that only the best of junior secondary school children could get as many items right as wrong in a simple test of formal grammar after four years of teaching. The majority of senior secondary school children were also incapable of answering the questions. From this Macauley deduces that it is idle to drill analytic techniques into most children, since the concepts involved are too difficult. Hunter Diack, in his book *The Teaching of English Grammar*, questions this conclusion and suggests that the teaching of grammar still has an important place in the schools. His views are in line with those linguists who emphasise a structural approach, such as that propounded by Fries in *The Structure of English* and Roberts in *Patterns of English*, and sponsored in this country by such men as Bruce Pattison and Randolph Quirk. In *The Teaching of English*, Randolph Quirk argues that more stress should be laid on the function of words in English and less on word types. For example, he argues, we are taught that words which denote activity are verbs, but a word like " taxation " which clearly denotes activity is not a verb. This approach is artificial: language lessons should deal with morphology, intonation, the way inflexions are used and the importance of word order. He supports Fries's notion that a good way to demonstrate the functional nature of language is by using as examples sentences composed of nonsense syllables which incorporate bound morphemes such as -s and -ly, and which demonstrate the importance of word order patterns in English. Such an approach should ensure a detachment from language and an ability to see it as a tool rather than as a master.

Once this groundwork has been done the higher classes can tackle the question of deviation from the general structural norms for various reasons. Deviations in verse or mannered prose are common for reasons of emphasis, form, intensity and the like.

Deviations in inflexion may be justified because they extend the span of meaning and give rise to harmonious stress patterns as in:

" Do not go gentle into that good-night,"

a line which illustrates also deviations in morphology justifiable in puns and other word play. Similarly, deviations from literal meaning in the use of metaphor can also be presented on this principle. There should always be an aesthetic reason for deviations that are in any way extreme. Such linguistic structures and vocabulary as are cited by Sir Ernest Gower in his *Plain Words*, for example, show that officialese is obnoxious because it uses deviant language for extraneous reasons—to browbeat the recipient to take note, for example—and is entirely devoid of real beauty.

There remains the practical problem of how children are to be taught to write grammatically if formal instruction is rejected as inefficient to this end. In the field of applied grammar Bagley suggests that the most frequent errors made by children are those which cause the greatest difficulty. She lists some items of language which have been found to give the greatest trouble to both English and American children in order of frequency. These give some clue as to which items should be concentrated on at the early age levels and which at later:

(1) The sentence as a unit—the complete thought.
   (*a*) the use of the initial capital letter and the final full stop;
   (*b*) avoidance of a series of sentences loosely strung together with " and ";
   (*c*) avoidance of loose participial constructions;
   (*d*) avoidance of vague " so " and " only " clauses.

(2) Agreement:
   (*a*) in number, between verb and subject—especially in the case of the indefinite pronoun subject, e.g. everybody;
   (*b*) in number, between pronoun and antecedent.

(3) Use of the capital letter for proper nouns and adjectives derived therefrom.

(4) The case forms of pronouns—particularly the relative " who."

(5) Verbs:
   (*a*) correct tense forms of verbs—especially irregular and " strong " verbs;
   (*b*) avoidance of the past participle in place of the past tense, e.g. I done it.
   (*c*) correct sequence of tense.

A common method of teaching these things, especially in America, is to try to eradicate errors without formal instruction in punctuation, agreement and so forth. It has been found that proof-reading is a very successful practice test and that individual graphs of progress stimulate learning of these things. But much work remains to be done on the efficacy of transfer to original writing. There is thus good reason for some of the " incessant strictures on the illiteracy of children and adults " in language and communication: there is no method of teaching the mechanical skills which has been found to be particularly efficient. The whole process is still largely hit and miss.

What is clearly to be avoided is the idea that spelling, punctuation and grammatical errors are mistakes only when they occur in the context of the English lesson. For this reason it is essential that every teacher be a teacher of English to this extent at least; in some schools English as a separate discipline has disappeared from the time table, which would seem to be carrying the idea a bit too far; this may be a result of the rather extreme view of the Norwood Report, which comments upon the dangers of having specialist teachers of English. Some cross-reference and co-operation, however, is essential and benefits all concerned. It is particularly useful in developing understanding of vocabulary. Concept formation involves classifying, relating, generalising—all processes which are sometimes short-circuited in that method of teaching vocabulary which necessitates learning the meaning of words in vacuo, fitting names to dictionary definitions and writing sentences to demonstrate the meaning of words met only a few minutes previously. This can be a dangerous practice: many words, such as " freedom," " apartheid," " conservative," " justice," etc., evoke an emotional attitude dependent in many cases on second order knowledge. It is essential that the meaning of words such as these be taught in as many areas of the curriculum as possible if critical thinking is to be a reasonable aim of English teaching.

The close dependence of English comprehension on other areas of the curriculum and on general reading has been demonstrated by Black in a study with training college students. He maintains that the results of this study apply also to children between 15 and 18. Basing his conclusions on the answers to objective tests, he found eight main sources of error. These were: failure to understand the writer's attitude, failure to appreciate irony, lack of knowledge of vocabulary, non-comprehension of allusions, ignorance of the nature of metaphor, lack of background information, failure to note the influence of context, and the intrusion of the readers' preconceptions. These present quite a complex teaching problem since the pupils need to acquire not only knowledge of special techniques but general knowledge and much practice in reading. Studies by Gray and Rogers show that the more " mature " readers had mastered the skills of word recognition, could grasp the meaning and could thus concentrate on evaluation of the ideas and organise them in relevant ways. Artley, in his work on the implications of the Gray-Rogers study, concludes that all areas of the curriculum should contribute to reading maturity. A study by Josephine Piekarz indicates that lower-level readers have difficulty in distinguishing between their own and the author's ideas. They tend also to concentrate on the literal meanings of the words and to give scant attention to implications or make critical reactions.

The practice of precis writing has many advocates because of its presumed value in promoting critical thinking—judgment of the relative importance of ideas and practice in the management of language. Gurrey advocates precis writing strongly, but insists that precis passages should be of use and frequently consist of material from non-school sources, such as *The Spectator*, *Listener*, *Times* and other periodicals which provide a fertile ground for G.C.E. selectors. Most grammar schools will be bound to teach precis because of the G.C.E. requirements, but there is as yet no objective evidence that constant practice brings about increased discrimination. The 1954 Report urges that precis be not taught

to children of thirteen or less. At this age the majority of children are still uncritical and it is important that their enjoyment be left them as long as possible.

Critical enjoyment in the sense of " Appreciation " is a matter for the final years and for sixth forms. It can emerge only after much practice in reading which will provide some basis on which to form a judgment. In this connection Gordon deplores the common practice of training children to assess and appreciate only " good " passages. He has shown that this may lead to failure of comprehension of the worth, appropriateness and functions of a style. He studied candidates' answers to a question on a 1942 University Entrance Scholarship paper which demanded a comparison between two passages: one a publisher's blurb of the worst type and the other a cool, critical piece by Newman. Forty-four per cent. of the candidates thought that the first passage was worth serious consideration and many of these thought that it was fine prose. Similar work has been undertaken by I. A. Richards, whose famous studies in " Practical Criticism " make a similar point on the inability of many undergraduates to form a balanced judgment of an anonymous passage.

Development of Expression

T. W. Irion did some studies with fourteen-year-olds in the United States. He used two prose passages, one of which was narrative, a poem, and a passage of blank verse dialogue from *Julius Caesar* printed as prose. He found that the pupils had most difficulty in understanding the significance of the poetry, had difficulty in making detailed comments on the drama, but could grasp the general significance, and that the prose afforded them the least difficulty. The reasons for this are the unusual nature of vocabulary, the word order and the morphemes to those not thoroughly acquainted with deviations from the norm of plain prose style. There seems little reason to inflict the more extreme linguistic deviations upon the unmotivated and so make their attitude yet more hostile. The primary tendency today seems to be towards making a child's reading and writing experiences relevant to his own mode of living and to giving him ample opportunity to express himself orally. To achieve these aims, a more active approach is necessary than that usual for the development of critical thinking. The supreme exponent of active methods was, of course, Caldwell Cook at the Perse School in Cambridge at the beginning of the century. Using the class as a social unit, he made full use of drama, debates and projects to increase the directly experienced knowledge of the boys. Marjorie Hourd, in her book *The Education of the Poetic Spirit*, shows how dramatization visibly increased empathic understanding in some girls. At many age levels in the secondary school, however, and particularly in boys, there is a strong " fear of feeling " and dramatization or the public expression of any personal emotion becomes often impossible. In some cases a devious expression of feelings is still possible and boys, if permitted, may act out their feelings at a symbolic level, on the Moon or some such stylised place: with the older boys this is no longer feasible. Suspension of disbelief becomes more and more impossible with 14-16-year-olds. In such cases one can encourage expression using active sources of stimulation in conjunction with a permissive environment (*not* an anarchistic one).

For example, it is common practice for schools to send parties of children on visits to theatre productions of Shaw, Shakespeare, Oscar Wilde and non-English dramatists

such as Bertold Brecht. Many schools make use of the B.B.C. radio services for schools and the television services where these are appropriate. Much research remains to be done on the effectiveness of these techniques. Use of special techniques is often a matter of finance and individual opportunity but most schools have school or classroom libraries where periods of free silent reading are catered for in the timetable. These are probably almost indispensable to progress for those children who come from noisy homes or homes where there is little or no reading matter. In all these special activities the boundaries of literature as traditionally conceived have to be extended and much that comes under the heading of history, geography and even science will be included. This is now normal practice: some schools, however, go further in this co-operation and one finds schools which run their own internal radio programmes, make their own films and print their own magazines. This sort of inter-subject co-operation has been explicitly recognized by the Associated Examining Board who, in their A-Level syllabus, include such set books as Hoyle's *Decade of Decision* and Lewis's *The Screwtape Letters*.

Many of these special activities give opportunity for the development of oral expression, an activity long neglected in the majority of secondary schools. Inadequacy in oral communication is a serious handicap today since speaking and listening are much more in demand than writing and reading. In many cases industries are having to set up courses in oral communication to remedy the deficiencies of their employees. Technical Colleges and Teacher Training Colleges are beginning to tackle the problem but ultimately much of the onus will fall on schools. Basil Harvey makes a convincing case for the creation of more ' O ' and even ' A ' level examinations in spoken English.

The problem is much the same in principle as it is in grammar, literature and writing. The primary aim has to be the simple establishing of an appropriate norm; deviations can be developed with students who have time and ability to explore them. In secondary modern schools in poor socio-economic areas, for instance, the aim must first be to instil some measure of proficiency in the prevailing vernacular by means of oral composition of one sort or another. The child can be encouraged to speak in sentences, use phrases not too interspersed with cliches and meaningless expressions, and to adapt his words and tone to his purpose. Later, on an optional basis perhaps, there may be some provision for training him to use a more widely socially acceptable language. Dr. Lewis stresses the need for oral practice to give skill and facility in the interchange of speech. This brings self-respect and confidence, he says, and is a means of securing the co-operation of others. Again, the problem of formal instruction arises and it is probably true to say that rigorous formal training will often create hostility. Many education authorities automatically issue tape-recorders to their schools now and there is no doubt that once children have grown accustomed to hearing their own voices played back after a session of free drama or informal discussion they can be astounded and elated at their own performances.

The normative approach is also operative in the teaching of written expression, which must, of course, be integrated with oral work. Writing for simple factual purposes is one of the main aims of the teaching of written English today, since this is all that the majority of children will be called upon to do when they leave school. This aim is endorsed by such bodies as the Associated Examining Board in their ' O ' Level English papers and

by the Royal Society of Arts. Such questions as " Describe how you would make a bed " or " Describe a vacuum flask as for someone who has never seen one " exemplify the type of work that is encouraged. The choice is unfortunate, since such assignments seem unlikely to arouse a high degree of motivation. In many cases the children practise the sort of work they may be expected to manage in their first jobs, such as writing reports, business letters and announcements. As early as 1921 the Board of Education, writing about Evening Continuation Schools, notes that a " vocational approach " to English was much more successful than the traditional " literary approach " which seemed to be widely detested.

There is another function of written expression, however, just as there is of speaking: that is the function of developing the child's personality. The criteria governing the whole of English language studies have shifted from " What ought the child to know? " to " What will develop the personality of the child? " It is common practice to encourage the child to give expression to personal experiences and feelings in such compositions as autobiographies, letters to friends, narratives or descriptions, depending on the age level of the child. After the age of fifteen, says the 1954 report, " the thoughts of the intelligent turn to exposition and argument "; beyond this age there seems to be a tendency for the expressive needs of the adolescent to be neglected in face of examination pressure. Muriel Kay has done some work with sixth forms in a girls' grammar school on the so-called therapeutic aspects of the teaching of English, work which involved considerable oral discussion, and she claims that the results are beneficial. There is little objective evidence to show that giving expression to personal experiences does develop the personality of the child—the concepts involved are too vaguely conceived.

The importance of this second function of written and oral expression—perhaps particularly oral—cannot be over-estimated. It is suggested that freedom of expression develops personality not in any nebulous way, because it is " good to express oneself," although a few may find relief in cathartic expression; but because, for the most part, for children to express something in their own way and note the results is an essential factor in the " reality-testing " process. The processes by which words and gestures become welded into an individual's style is subtle and devious. Identification is often a forceful one at these age levels; imitation is potent, too; rational instruction, the pressure of group opinions and the way in which rewards and punishments stress components of verbal behaviour are all important factors. Detailed examination of these is, however, beyond the scope of this article.

Conclusion

From time to time there can be observed in educational publications a tendency to project the aims of education as a whole on to the English course—witness the three-fold ideals of the Spens Report—but basically the aims can be restricted to two: the development of language as a comparatively non-social activity, in critical thinking, and, more important, the primarily social aim of developing what may be called the reality-principle in the child, that is, assisting him to maturity. Achievement of these aims is dependent on two factors; the possession of communication skills and the possession of a body of knowledge or ideas, acquisition of which is in turn dependent on motivation. The modern

trends are towards a permissive but guiding environment, active techniques, great emphasis on oral expression and continuous recognition of the fact that appreciation is dependent on enjoyment. This may mean allowing the child to speak, read and write on his own level unharried for a while, even where his performance is below average, in order that enjoyment may not ebb away. Only thus can illiteracy in both senses of the word be diminished.

Objective research still lags; much remains to be done on the effectiveness of motivating techniques, gradations of difficulty within the mechanical skills, and on student-teacher guidance. The fundamental problems of the English teacher will remain, however, since he is not so concerned to impart facts as to provide opportunities for children to develop according to the ancient maxim "Know Thyself"; how this can be done from day to day only he can assess.

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TEACHING ARITHMETIC BY CONCRETE ANALOGY — I. MIMING DEVICES*

by J. D. Williams.

Introduction

Object

In the first article in this series, an attempt will be made to classify, compare, and, to some extent, analyse, some of the concrete devices at present available for use in the teaching of primary school arithmetic. In later articles some systems of teaching that entail the use of these devices will be compared, and the rationale supporting such systems will be examined.

This article does not describe all of the devices, or even all of the *types* of device at present being used in schools; for the most part, those devices described are used in the systems that are to be dealt with in the later articles.

It is hoped that this article will bring to the notice of teachers material with which they are not yet acquainted, and, by revealing certain general characteristics of different kinds of device, give a truer perspective of those with which teachers are already acquainted.

The Devices

The sort of material we shall be considering—that used in such teaching systems as the Montessori, Stern and Cuisenaire—consists of what might be called ' concrete analogues.' These analogues represent in concrete form the *elements* of arithmetical operations, and can be used as *miming devices*, with which to parallel, or ' mime,' derivative arithmetical operations. Using these, it is possible to present arithmetic, not in its usual symbolic form, but in a concrete form that is thought to be more intelligible to the child. Such devices should not be confused with the following:

(1) Apparatus (coins, etc.), such as is used in *environmental teaching*.

Real-life situations can sometimes very accurately depict arithmetical operations in a concrete form that is very readily understood by the child: e.g. Joe will understand perfectly that if he shared a cake with four other children, he would get a smaller piece than if he shared it with only *two* others, whereas he might be puzzled that $\frac{1}{5}$ contains a larger number than $\frac{1}{3}$, but represents a smaller fraction. The use of such situations differs from the use of our concrete analogues in some important respects:

(*a*) Real-life situations are complicated by many irrelevancies, which often obscure or distract from the arithmetical relationships to be depicted.

*The distribution of teaching methods using some of the apparatus described in this article is given in 'Distribution of Methods of Teaching Arithmetic in Primary Schools in England and Wales' by J. B. Biggs in this number of Educational Research.

(*b*) Any one such situation is not likely to depict more than a fragment of the arithmetical system.

(*c*) Although, with the use of a great many real-life situations, it should be possible to depict a great deal of arithmetic, these situations taken together would not present a coherent whole of a sort that would illustrate the interrelatedness of the arithmetical system.

In order to exclude mathematical irrelevancies, to cover the essentials of mathematics and to show their interconnections, it is necessary to *devise* situations that reflect as precisely as possible the *fundamental elements* of arithmetic, and that can be manipulated in ways that will parallel the arithmetical manipulation of these elements. To a greater or lesser extent, the devices to be described fulfil these requirements.

(2) Mathematical models.

Much of geometry is devoted to the description of spatial arrangements that are difficult to visualise or to depict on paper. Often, therefore, models are constructed as instances of particular mathematical descriptions. Such models are essentially different from the devices that we are concerned with. These models are *mathematically complex*. They are *not* constructed to mime *fundamental* processes in mathematics as are our analogues, and, consequently, they cannot be used to parallel such a diversity of *derivative* processes.

Spatial Depiction

In the case of *most* of the devices to be described in this article, mathematical operations are depicted *spatially*. Since at its origin mathematics was probably devised largely to parallel such spatial aspects of the environment as groupings, arrangements and sizes, it is no coincidence that such spatial aspects can be used to parallel mathematics. Many of the rules according to which objects can be manipulated and arranged have become very familiar to the child in the course of his daily commerce with the environment, and in terms of these he can learn to understand those rules that govern the use of mathematical symbols.

However, not all of our devices are concerned with arrangements and sizes of objects, and those that are not are less immediately intelligible to the child. The balance, which will be described later, certainly parallels many mathematical operations, but the rules according to which it, itself, operates, must be learnt and accepted by the child before this device will help him to understand mathematics. Again, Cuisenaire's colour representation of number must be associated with a spatial representation before it becomes intelligible to the child.

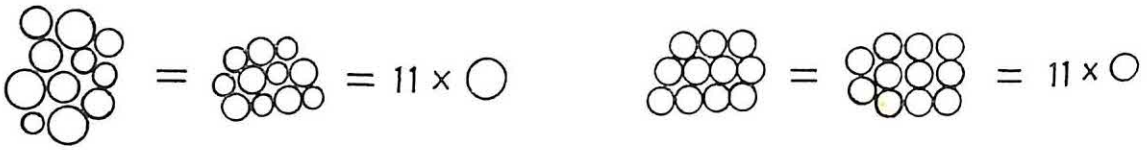
Since we shall be considering mostly *spatial* devices, we shall first examine some features of the arrangement of objects—for certain of these features are obvious determinants of the scope of spatial representation.

Grouping and Measuring

One could depict a great deal of mathematics using no more elaborate a device than simple groups of objects: the cardinal properties of number could be represented by the number of objects in a group, the ordinal properties could be represented by giving

objects a numerical significance according to their position in a linear arrangement, and the relation between cardinal and ordinal properties could be represented by arranging groups of objects in order of size of group.

However, the devices that we shall be considering are more than just groups of objects, for they make use of *units*. This means that the objects in the groups are all *spatially equivalent*, so providing a visual cue that tells us something about the size of a group even if we do not count its members. See fig. 1.



(*a*) Depicting equality without spatial equivalence of units.

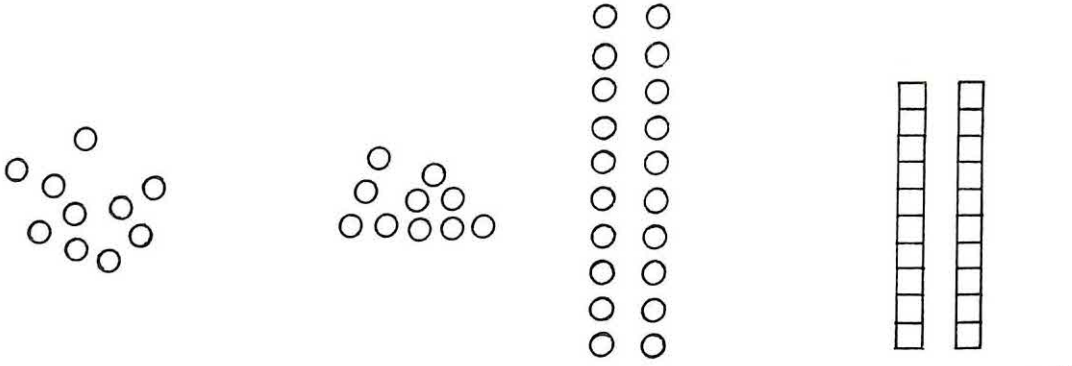
(*b*) Depicting equality *with* spatial equivalence of units.

FIG 1

Thus, using spatially-equivalent units, we can represent numerical size by physical size.

But even though we have units, we cannot get more than a *rough* impression of the comparative size of large groups unless we can arrange these units in such a way that those of one group can be *matched* with those of another. A simple way of doing this is to arrange the units at equal distances from one another in a straight line. Where the units are pegs, this arrangement can be ensured by using a pegboard whose holes are equidistant and in straight lines. Where the units are cubes, these can be juxtaposed. Such an arrangement of units simplifies considerably the business of comparing the sizes of different groups, for now the groups can be *measured* against one another, as shown in fig. 2.

COMPARISON OF TWO GROUPS OF SPATIALLY-EQUIVALENT UNITS



(*a*) When units are unaligned

(*b*) When units are aligned

FIG 2

In (*b*) it can be seen at a glance that Group 1 and Group 2 are exactly equivalent, while in (*a*) their exact equivalence would not be recognised without counting.

Subgroups and Dimensions

We now have a much clearer way of representing relative size, but we can go even further than this, and use a strategy that will enable us not only to represent this even *more* clearly, but to depict numerical relationships of a more advanced kind. This is the strategy of *subgrouping*. There are two advantages in subgrouping:

(1) The numerical qualities of large groups cannot be visually appreciated so readily as can those of small groups. Thus, ooo ooo ooo is clearly three groups of 3, whereas oooooooo is by no means so clearly 9.

(2) It is often possible to express mathematical relationships more fully by subgrouping. Take $6 \times 2 = 4 \times 3$. This could be expressed thus: oooooooooooo = oooooooooooo, but could be expressed much more informatively by: oooooo oooooo = oooo oooo oooo.

We still have not fully exploited the possibilities of spatial representation, for, so far, we have been grouping units in only *one* dimension. *Three* groups of 3 objects can readily be appreciated when arranged in a line, but what if we had *nine* such groups? For example: ooo ooo ooo ooo ooo ooo ooo ooo ooo. In this arrangement, the number of subgroups is too great to be appreciated visually, and if the objects used were of any size they would be difficult to arrange in this manner on a desk, and certainly difficult to see as a whole.

Let us now bring in another dimension, and arrange the units thus:

ooo ooo ooo
ooo ooo ooo
ooo ooo ooo

This two-dimensional arrangement simplifies the visual representation considerably, for we can now see at a glance that we have three groups of 3—that is, 9—and we can also see that we have this three times—making 27.

But say we had 81 objects. If we confined our structuring to two dimensions we should again be in trouble, for again we should have *nine* groups to manage, each, this time, containing 3×3 objects.

Hence the usefulness of a *third* dimension, enabling us to reduce this number to three groups. In fig. 3 there are 81 objects divided into what are very obviously three groups, each of which is divided into what are very obviously three subgroups each of which is divided into what are very obviously three *sub*-subgroups each of which contains three objects. In this case we have used cubes as our units, for these are easier to draw.

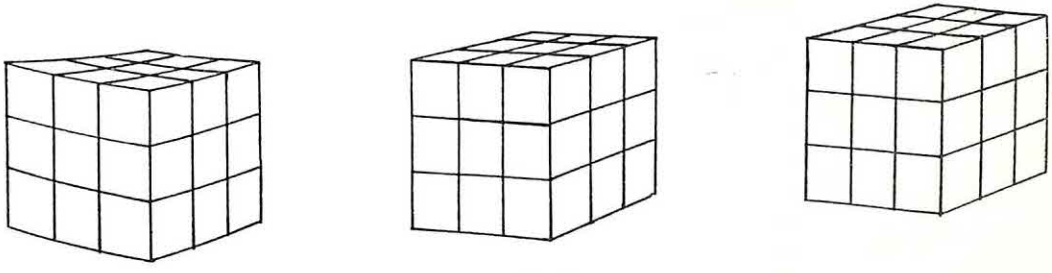


FIG 3

We have seen that grouping can help to depict a multiplicative relationship, and since

the use of extra dimensions facilitates grouping, we can expect that the more dimensions we use, the more multiplications we shall be able to express. Thus, in one dimension we might have Y groups of Z objects, in two dimensions X groups of Y subgroups of Z objects, in three dimensions W groups of X subgroups of Y sub-subgroups of Z objects. If, then, our device will allow us to use all three dimensions, we shall be much more conveniently able to express a multiplicative relationship involving many terms. Not all of the devices to be described can conveniently be used in three dimensions.

The Abacus

This is usually a frame supporting several wires each bearing ten counters. As shown in the diagram, the counters on the first wire represent units, those on the second, tens, and so on. Counting is represented by moving counters from one end of the wire to the other. In fig. 4, one hundred and twenty-seven has been counted.

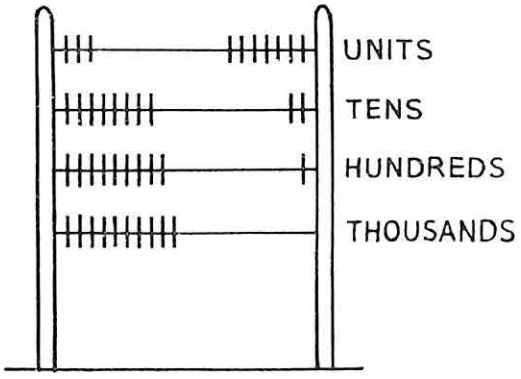


FIG 4. AN ABACUS

When ten counters have been moved on one wire, they are returned to their former position, and one counter is moved on the wire representing the next order of ten.

This device, *within each order of* 10, represents numbers by numbers of objects, thus making the counting process more intelligible to the child. It also enables the child to practise working in tens and hundreds at an age at which he would probably be incapable of doing so on paper. However, it has the following disadvantages:

(1) When adding, say, 5 and 8, the child will be able to move 8 beads along the wire and see what these add up to, but will not be able to see in front of him the 5 beads he is adding to the 8; as a consequence, it is possible that he will carry out his adding blindly, without an appreciation of the quantitative significance of the numbers he adds.

(2) Although one counter on the tens wire is equal to ten on the units wire and one on the hundreds wire is equal to ten on the tens wire, this difference in value is not physically represented by a difference in size, and this will allow the child to forget the difference in quantitative significance of the different wires.

A variant of this device that attempts to represent physically the quantitative difference between tens and units is the Leighbridge Counting Frame. This has only two wires, one bearing big beads, representing tens, and one bearing smaller beads,

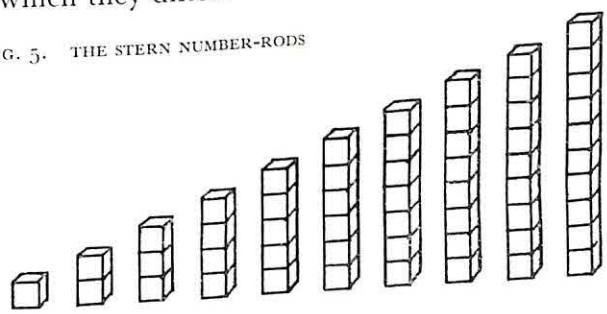
representing units. However, although this makes it clear that tens are worth more than units it does not demonstrate *how much* more, and, of course, although it enables the child to substitute a ten for ten units, it does not allow him to *construct* a ten out of ten units, as do some other sorts of apparatus.

In the Montessori Abacus the counters on the units, tens and hundreds wires are respectively green, blue and red, and so are those on the 1,000s, 10,000s and 100,000s wires. Since this colour scheme is also used to represent orders of ten in some other Montessori apparatus, it will serve to remind children of the difference in quantitative significance of the different wires. In Montessori teaching, this abacus is used only when the teacher is sure that the pupil realises the quantitative significance of difference in orders of ten, and is ready to appreciate a symbolic representation of this difference in terms of colour and position.

Number Lengths

These are devices in which numerical size is depicted by at least the length of the object. The Stern number-rods, an example of this sort of device, are shown in fig. 5. Number-lengths differ in many respects, and we shall consider them under the headings of those respects in which they differ.

FIG. 5. THE STERN NUMBER-RODS

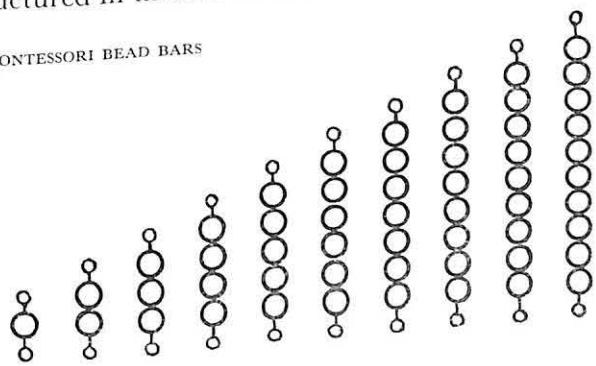


Shape

(*a*) *Multiples of a unit cube*

Many number-lengths are multiples of a unit cube. The Stern, Cuisenaire, Unifix and Dienes are like this. These have the advantage that they can be structured in three dimensions with equality of unit-value in all three dimensions. Thus, X^3 or $X \times X \times X$ could be structured so that X would be represented in the same way each time. The Montessori number-lengths, shown in fig. 6, are composed of small spherical beads and can be similarly structured in three dimensions.

FIG. 6. THE MONTESSORI BEAD BARS



(*b*) *Multiples of a unit square*

Some number-lengths are multiples of a unit square. The Montessori addition strips and the Arnold measurement stair are of this sort. Since these are flat, it is easy to superimpose one upon the other, see fig 7. This facilitates the measurement of one in terms of another, and the illustration of differences and ratios.

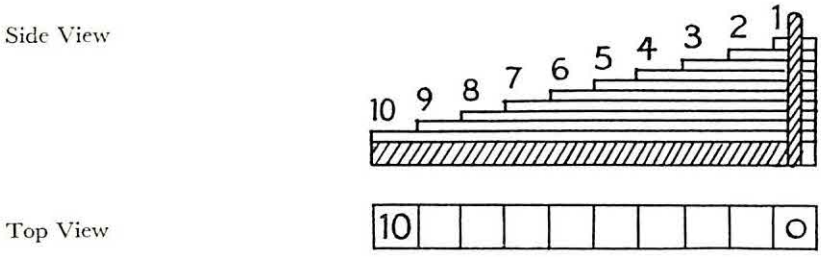


FIG. 7. THE ARNOLD MEASUREMENT STAIR

(*c*) *Others*

The Montessori number-rods are in multiples of units that are square in cross-section and oblong in side.

The Shaw number-lengths are cylindrical structures that are multiples of cylindrical " number-pegs," of which the diameter is larger than the height; see fig. 8.

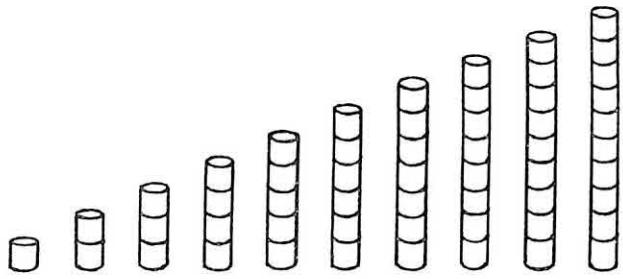


FIG. 8. THE SHAW NUMBER-RODS

The Avon equivalent to number-lengths consists of multiples of unit squares, each bearing a dot, arranged as shown in fig. 9, so as to form a pattern for each number, as well as to represent quantity by size.

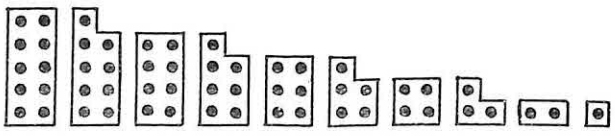


FIG. 9. THE AVON NUMBER-PIECES

Size

The Montessori number-rods are the largest, the unit length being 10 cms.

The unit length of the Stern and Unifix is $\frac{3}{4}$", the Arnold measurement stair, 1", the Shaw, $\frac{1}{2}$", the Cuisenaire, 1 cm., and the Dienes, almost 1 cm. The unit squares of the Avon apparatus are of side 1".

Since the Dienes apparatus includes lengths of only 1, 3, 4, 5, 6 and 10, and these are constructed of units roughly the same in size as the Cuisenaire units, the Cuisenaire rods could be used to supplement the Dienes apparatus for more elementary work.

Because they are so large, the Montessori lengths are suitable for use with very young children. Of the others, the larger lengths have the advantage that they can be more easily manipulated by children than the smaller ones, and are easier to see in class demonstrations. On the other hand, larger lengths take up more room, of course, and when the child is working with larger numbers on the limited space provided by a desk, the smaller lengths are at an advantage. Again, many structures which could be appreciated in their entirety when constructed out of small pieces, would be too large to be "taken in" at one glance if constructed out of large pieces.

Some lengths structure vertically—others more conveniently structure horizontally. The advantages of vertical structuring are:

(1) The structure can be used for teachers' demonstrations.

(2) Less room is taken up.

(3) Rows of rods can be arranged behind one another without smaller rods being obscured by bigger ones, as they would be if they were laid on top of one another. This facilitates comparisons of relationships and the setting-out of arithmetical examples in rows, as they are set out on paper.

(4) By using another dimension, the units in a structure can be grouped in an extra way. This reduces the number of units to be apprehended in any one dimension, and thus produces a terser visual presentation. See the introduction for a fuller account of the advantages of three-dimensional representations.

The Shaw rods structure vertically, and peg into a base and into one another to form a very stable structure. Unifix rods can also be structured vertically with great stability, for these can be pegged into one another. In the case of the other devices, vertical structuring is more difficult but not impossible. The Stern and Avon lengths can quite successfully be structured in a near-vertical tray.

An advantage of the Unifix rods is that they can be so stably structured that composite rods can be manipulated in any position without falling apart.

Segmentation

The Cuisenaire rods are not segmented into unit lengths, so the child is unable to perform his calculations by counting. Take the sum $3+4=7$. With the segmented lengths the child might find that a 3-length and a 4-length equal a 7-length by counting the segments of the 3 and 4-lengths and seeing whether he reached the same number as when counting the segments of the 7-length. This would prevent the child from seeing that *the entity* 3 plus *the entity* 4 equals *the entity* 7.

However, segmentation does have its advantages, for it

(1) enables the child to judge much more quickly the value of the lengths he is manipulating;

Comparative Summary of Devices used in Different Systems

	Shaw	Stern	Unifix	Avon	Cuisenaire	Montessori	Dienes	Lowenfeld	Bass	Arnold
Abacus.						Value indicated by colour.				Value shown by size.
Number Lengths.	Cylindrical vertically-structured.	Wooden blocks.	Vertically or horizontally structured. Components attachable to one another.	Flat pieces 2 units wide, bearing one dot per unit.	Units not marked on rods, which have colour values.	Large wooden blocks and small bars of beads.	Lengths not provided but can be constructed with M.A.B. pieces.	Lengths not provided but can be constructed.		Measurement stair of flat numbered pieces.
Containing and measuring devices.	Base with two rows of 10 holes divided by groove.	Trays holding squares of numbers from 1-10 and 20.	Container divided into five 20-unit channels.						Counterplay board.	
Number-stairs.		Number-stair holder.	Number-stair holder. Number boats.							
Number tracks.	Bases can be juxtaposed.	1-100 track with units marked.	1-20 track with 1-10 track joined.	Number channel with tens marked.						
Positional notation.	Tens and units card.	Dual board holding 10 tens.	Holds only 5 tens.	Holds only 9 tens.			Teacher constructs own.			

Charts, etc., for measuring.	*Multiplication* Chart and 100-Chart.	*Multiplication* Machine.				Multiplication board. Addition strip board.			Convecta board.	
Number Patterns.		Pattern Boards with pits for cubes.		Patterns on Number-pieces.		Patterns formed out of counters.				
Pegboards.	Pegs structurable vertically.					Pegs have colour value. Division Board.	For use in A.E.M.			
Fraction devices.		Fraction plates and frames.				Insets, skittles, and device for decimals.		Pieces showing *shapes* of fractions.	Convecta fraction board.	Keighley fraction board.
Balances.							For use in A.E.M.			
Devices illustrating powers.		Grooved wooden blocks to base 10.				Joined beads to base 10.	Grooved wooden blocks to various bases.			
Some devices for illustrating algebra and geometry.					Geoboards.	A variety of devices including flat shapes.	A.E.M. apparatus including triangular and rectangular slabs of wood.	Shapes, areas and volumes demonstrable.		

NOTE: (1) Systems often make provision for operations, without using specially constructed devices, so this table does not reflect comparative comprehensiveness.

(2) " Unifix " refers to a *set of materials* rather than a " system," and " Arnold " to the *supplier* of certain devices.

(2) provides opportunity for the child to realise that end products can be reached by counting as well as by combinations of groups;

(3) is useful when depicting many multiplicative relationships. For example, the commutative law can be illustrated by three segmented lengths arranged in these two ways:

FIG. 10

Because of the segments this can be seen equally well as three rows each 4 units long, or four rows each 3 units long.

Colour

The Stern, Shaw, Unifix, Montessori and Cuisenaire number-lengths all have different colours for different lengths. However, in all but the Cuisenaire, the colours are used merely as an aid to discriminate between different lengths—to give a clearer picture of where one begins and another ends when two are placed end-on, for example.

In the case of the Cuisenaire rods, colour is of central importance. The unit is white and the 7-rod is black, but the other rods are grouped in colour families: the red family (vermilion for 2, crimson for its double, 4, and brown for the double of that, 8); the blue family (light green for 3, dark green for its double, 6, and blue for its treble, 9); and the yellow family (yellow for 5, and orange for 10). Pupils learn to associate the colour with the length and numerical value of each rod, and commit to memory such facts as " black minus red equals yellow." Thus, a sort of " colour notation " is learnt. This is held to be easier to grasp than the usual number symbols, because children are already familiar with colours, and these form an actual perceptible characteristic of the number-rods. Further, the colours constitute a means of grouping related numbers into families.

Unfortunately, these colours are not intrinsically analogous to the numbers they represent—unlike spatial devices, they have no characteristic such as size to parallel number operations, and children might well carry out operations with colours without an awareness of the mathematical significance of these operations.

The Dienes and Avon pieces are not coloured, but it is possible to discriminate between the Avon pieces by virtue of the number of dots on each, and the difference in shape of odd and even number-pieces.

Numbering

All of these devices excepting the Cuisenaire and Dienes have numbering and measuring accessories, but most of these are in the form of containers or cards. However, the Avon and the Arnold Measurement Stair have the value of each length written on it, and the values of the Unifix lengths can be attached to them.

The Avon pieces have large blue numbers on their backs, and this enables the pupil not only to identify each piece with its number, but to use pieces for measuring others. This is done by simply inverting the measuring pieces and covering the pieces to be measured with them; see fig. 11.

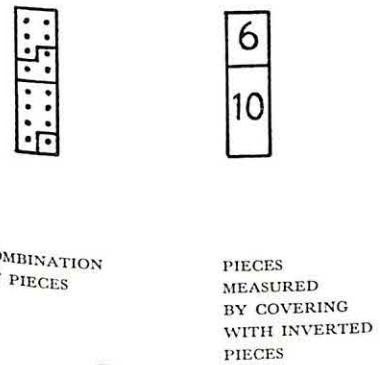


FIG. 11

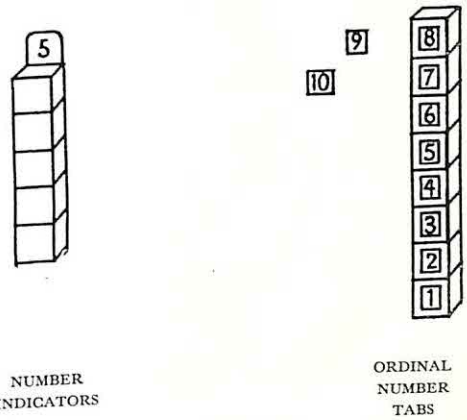


FIG. 12

There are " Indicators " that can be attached, if required, to the ends of the Unifix rods, as shown in fig. 12. However, these prevent the attachment of another rod to those ends. Again, " Ordinal Number Tabs " may be attached to and removed from the sides of the Unifix cubes. These can be used to facilitate the appreciation of the ordinal properties of number.

The Arnold Measurement Stair has numbers at the end of each number strip. It should be noted that in these devices, the use of numbers is optional. The Avon pieces need not be inverted, the measuring stairs *can* be inverted, the Unifix numbers need not be attached.

Accessories for Containing and Measuring Number Lengths

These accessories have three sorts of function:

(1) They serve as a guide and an aid to certain operations that are performed with the number pieces.

(2) Some provide a *spatial* indication of the result of a structuring—in terms of whether or not the structure fits the container.

(3) Some provide a *symbolic* indication of the result of a structuring—in terms of the number on a measuring device with which the structure coincides. In these ways the accessories enable children to do much more of their work by themselves and to discover immediately the results of their efforts without appeal to the teacher. Younger children will need the sort of spatial indication of results that is provided by the various Stern trays, but older children will be greatly helped by the symbolic indication provided by the Shaw cards.

We shall consider these accessories under seven headings.

1. *Simple Number-Containers*

The simplest of these is the Stern unit box, which is a shallow square tray, 10 × 10 units. By arranging blocks in it, the composition of 10 can be illustrated. A staircase of blocks can also be arranged in it. The Stern number cases are smaller square trays like that shown in fig. 13, in each of which can be shown the composition of one of the numbers up to 10. There is also a Stern 20-case, which is divided in the middle to form two 10 × 20 unit compartments, in one of which numbers up to 10 can be blocked out, and in the other of which numbers up to 20 can be represented.

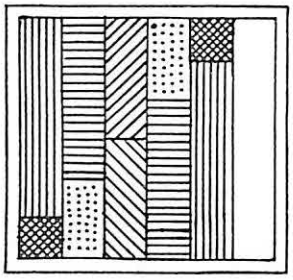


FIG. 13
THE STERN 6-CASE, SHOWING THE COMPOSITION OF 6

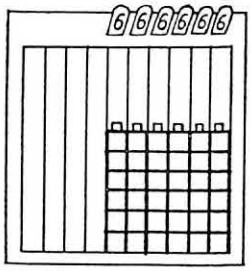


FIG. 14
THE UNIFIX TRAY SHOWING 6 × 6

The Unifix 10 × 10 number tray is divided into ten 10-unit compartments. As shown in fig. 14, number indicators can be placed at the end of each channel to show how much it contains.

These channels are of great use in comparing different operations, and enable the child to build a stable structure in less than the whole of the tray; also they help to hold the rods firm while these are being structured vertically. The Avon apparatus, shown in fig. 15, has five of such channels.

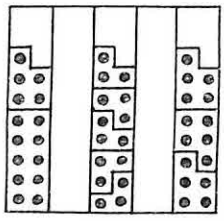


FIG. 15
THE AVON BOARD, SHOWING TWO INTERPRETATIONS OF 15 ÷ 3

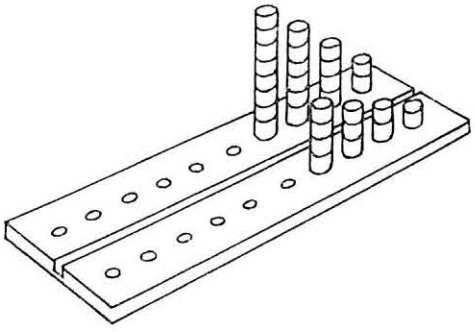


FIG. 16
THE SHAW 20-BASE

The Shaw container is a base with two rows of 10 holes and a groove between the rows into which cards may be slotted. Number-rods and pegs plug into these holes. Several of these bases may be combined to form a larger base. Because of the vertical

structuring of the Shaw rods, rows of structures can be arranged behind one another for comparison, as they are in fig. 16. This, of course, is also possible in the case of the Unifix materials, for these, also, can be structured vertically.

2. *Number-Stair Holders*

These consist of a series of 10 grooves, from 1-10 units long, arranged in order of size. The size of each groove is indicated at one end. Number-lengths fit into each of these to form a number-stair. This device is included among both the Stern and the Unifix materials. The Stern version is shown in fig. 17. The Unifix number-boats, separate containers to fit each rod, can also be arranged to form a number-stair similar to the permanently structured one.

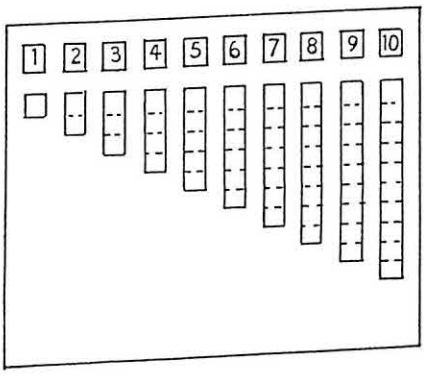


FIG. 17. THE STERN COUNTING BOARD

This device is particularly useful for relating the ordinal aspect of the number rods (their position in the series) to the cardinal aspect (the number of units each contains), but can also be used in *many* operations in which a device is needed for checking and giving a number to a rod or rod-composition.

Editorial Note: Owing to lack of space in this issue, the remainder of this article will be published in Vol. III, No. 3, June 1961.

The author would be grateful for any information about variants of the materials described, or other kinds of material. Please address communications to J. D. Williams, N.F.E.R., 79, Wimpole Street, London, W.1.

STUDENT GUIDANCE IN TECHNICAL EDUCATION

by F. Barr

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Introduction

DESPITE a large measure of common agreement about the importance of technical education, the problems of technical colleges are less well understood than those of other sectors of our educational system. Teachers and parents, for example, warmly debate the 11-plus selection procedure, the relative merits of tripartite and comprehensive forms of secondary school organisation and even the choice of, for example, the look-and-say or phonic methods of teaching young children to read. Few, however, would be prepared even to explain the meaning of terms such as "joint apprenticeship scheme" or "part-time day release." Most parents have decided views upon the type of secondary school they would like their children to attend; few would care to advise them on a choice between a national certificate or City and Guilds course in a technical college. Almost the only fully discussed problems of technical education are the need for greater numbers of better technical personnel of all grades and the failure of large numbers of technical college students to complete their courses successfully. It is, therefore, worthwhile having a look at some of the problems facing young workers in their choice of courses of further education and studying any such information we have which may suggest how effectively such choices are made and how they might be improved.

Levels of Failure

Perhaps the clearest indication that some improvement is essential is to be found in the figures for wastage or failure. Broadly, the proportion of those who enter on a given course and who either fail the terminal examinations or withdraw before completing it gives some clue to the effectiveness and realism of the initial choice made by the students—even though, as Jenkinson has pointed out, a course is not necessarily wasted if a student does not gain a certificate or does not complete it in the minimum time.

Among those concerned with technical education, there is a general impression that failure and frustration (among staff and students) are higher than elsewhere in our education system. We need to know what the actual rates of failure and withdrawal are and we must ask whether these are endemic, or simply the results of particular circumstances—for example, a bad batch of students suffering from the wartime and post-war dislocation of education—whether they are local or restricted to particular courses such as engineering, building or commerce.

Wastage figures from various parts of the country referring to several groups of studies have been reported. The most complete figures from pre-war days are those cited by Emms. He found that throughout the country in 1938-9, of the students of general building, 35% left between the first and second year courses, 40% between second and

third year, and 52% between the third and fourth years. He noted that this degree of wastage had the result that 13% only of the original first-year students remained to enrol for higher national certificate courses. Post-war reports show similar high levels. In 1955, Jenkinson reported from a college in the industrial north-west that of 171 students of first year ordinary national certificate mechanical engineering, only 10 passed higher national certificate in the minimum time of five years. Smith and Wilkins found that of the 326 students in the commerce department of the Mid-Essex Technical College at Chelmsford, at the beginning of the first term of a new session, 80 (25%) had made no attendance during the first three weeks of the second term.

Not only are similarly high levels of wastage recorded in several parts of the country and in different college departments over a period of years but they have been found at various levels of study within Colleges. Boyce, for example, notes that more than half the classes at the secondary school level in the commerce department of the Welsh College of Technology at Cardiff had a withdrawal rate of over 50%; at the intermediate level over two-thirds of the classes had a withdrawal rate of 30%; and at the university level about three-quarters of them had a rate of 30% and over.

There are differences, too, in the levels of wastage according to whether classes are held in the evenings or during the day. Brosan found in Willesden Technical College that wastage rates in the evening classes were twice those of the day classes. He adds that, as a whole, the rates varied from 42% for the first year classes to 5% in the fifth and final years. Information from a somewhat different source, this time an industrial Apprentice School, confirms these technical college conclusions, for in a study of both City and Guilds and national certificate courses between 1951 and 1956, covering all levels of work, Liepmann found failure rates varying widely from 14% (second year Intermediate City and Guilds course for 1953-4) to 75% (fifth year Final City and Guilds course for 1952-4).

Perhaps the most comprehensive information is given by an investigation undertaken for the Crowther Committee. An analysis of the results of 5,786 national certificate students of engineering, building, science and commerce showed that only 26% of entrants passed the ordinary national certificate and only 10% the higher certificate. Of 2,977 students enrolled in City and Guilds courses covering a wide range of crafts, only 28% passed the Intermediate (three-year course) and 6% the Final Certificate (requiring two more years of study). The enquiry showed, too, that of the original first year national certificate entry, only 21% remained in the third and final year before the ordinary national certificate is taken, and this is reduced to only 3% by the fifth year when the higher national certificate is sat.

For comparison, these levels should be set against wastage rates in grammar schools and universities (where, of course, conditions are much more favourable). The Ministry's report, "Early Leaving," indicates that between 10% and 15% of grammar school children withdraw before sitting the G.C.E. 'O' examination. Jenkinson cites a wastage rate of 15% for English universities. We might also recall that the large majority of fifteen-year-old children never enter any form of further education after leaving secondary school; and this is perhaps the biggest wastage of all from the educational system.

However we look at it, and whether or not we are agreed that all or most adolescents should continue in some form of vocational and educational training after the end of compulsory schooling, it is clear that the high proportion of those who begin but fail to complete such courses is disturbing. It represents a waste of hopes, and of effort, a waste of potential skill and possibly a seriously uneconomical use of teaching resources. No major research of a national kind* has as yet been devoted to finding out why the failure rates are so high and how they might be diminished. But even a cursory analysis of what we do know suggests some at least of the reasons.

Some Possible Reasons for Failure

Complexity of Courses and Examinations

Technical colleges provide a wide variety of courses, ranging in level, from secondary school to university; in content from architecture and astronomy to zoology; and in purpose, from those which are strictly vocational to those mainly concerned with the use of leisure, such as handcrafts and gymnastics. Students of all ages may attend these courses so that within the same college, and not infrequently within the same class, will be found younger and older people from the mid-'teens to the mid-fifties or older. If we leave aside the leisure-time courses, vocational subjects are frequently organised into several departments of which the various forms of engineering—electrical, mechanical and production—applied science, commerce and building, perhaps account for the largest proportion of students. Within such departments there is a major subdivision between those courses preparing students for national certificates and those which give a mainly craft training leading in general towards a City and Guilds of London Institute certificate. We cannot deal with all these varieties of levels and kinds of course individually. Hence we will, at this stage, narrow the focus of attention and look at, as an example, the national certificate courses more closely. This will permit us to expose the hurdles which students must overleap to complete the course successfully.

Most students who attend these courses are released by their employers on full pay for one day each week, and, in addition, may have to attend some evening classes. The course involves sustained attendance for three years if they wish to sit for the ordinary national certificate, these annual sessions being known as S_1, S_2 and S_3 respectively. Some, by virtue of holding satisfactory G.C.E. 'O' qualifications are exempt the first session and may enter S_2, whilst others who are not of S_1 entrance standard may be required to take a preliminary year's course. After being awarded an ordinary national certificate at about the age of nineteen years, a student may continue to study for a further two annual sessions, A_1 and A_2, for a higher national certificate and thereafter for further sessions if he wishes to add, for example, to his N.H.C. in mechanical engineering, qualifications in another branch.

Even in the early stages, students must be careful to choose the prescribed combination of subjects, which all adds to his difficulties of choice. This is further complicated by the requirements to be fulfilled before the certificates are awarded. As several of the reports considered refer to students who studied between 1947 and 1955 we may take Foden's

* There is, however, an extensive and large scale investigation of student placement in one large technical college conducted by Dr. E. Venables, Nuffield Research Fellow, Institute of Education, Birmingham.

account of the examining structure published in 1951. The examinations set at the end of the S1 and S2 sessions are prepared and marked by college staff or a local examining body. At the end of the S3 year the papers to be set and the scripts themselves are subject to the scrutiny of assessors appointed by the Ministry and the professional organisation or institution concerned. Both of these have the option of putting questions of their own as substitutes for up to 40% of the total number of questions set. They are empowered also to make up to 40% of the total number of questions compulsory. Finally, they assess the scripts. Moreover, during each year each student must have a 60% attendance record and have obtained 40% of all possible homework and classwork marks during the final year as well as 40% of the examination marks. The latter are weighted in the final assessment of marks to account for 70% of the total of which the student must have obtained at least 50%.

It is evident from this that a student may have to repeat a whole year's study if he fails in any part of the session's work in any part of the examination or if he does not attain the 60% attendance. Elliot found that of 1,874 students in a preliminary course, 348 had to repeat it and eventually only 49% passed into the next, S1 year. Venables, however, noted that if students who had failed in one subject only in the first year examinations had been allowed to enter the second year the wastage rate would have been cut by half to 22%. Jenkinson reported in 1955 that of 69 students who gained higher national certificates in 1952, 53 and 54, only 41 had passed through the course in minimum time. A tribute to the persistence of some technical college students is revealed by his further remark that of this group, 11 failed once, 8 twice, 7 three times, 1 four times and 1 five times (that is, this last student took ten years to complete a five-year's course; had he been a grammar school pupil he would have passed his G.C.E. 'O' level not at sixteen years but at the age of twenty-one). Hutton also discovered a similar persistance among some students in Rotherham Technical College who took up to six years to complete a three-year's course, and Lady Williams cites other examples in her case studies of colleges. When this situation is reached at all frequently, one is tempted to ask whether attainments or persistence is being measured; and whether indeed this persistence could not be put to more profitable use by better guidance at an earlier stage. One may question the human wisdom of a situation which evidently discourages so many and exacts a kind of blind doggedness of others; and finally, one may ask whether the repetition of a whole year because of a failure to satisfy teachers or examiners that one of a number of subjects has been mastered, really results in an improved performance later.

Students' faulty choice of careers and courses

Some of the problem undoubtedly lies in a faulty choice of course—faulty either because it has no apparent (or actual) relevance to the chosen career, because the career itself is not the right one, or because the student has over-estimated or wrongly judged his capacities to study it in the actual circumstances in which he will work. Often it is a combination of all these.

Technical college courses, in the main, are designed to give an education specifically geared to a particular career and if the career itself is badly chosen, however good a course may be, students will almost inevitably reap less than a full measure of benefit

from it. Most young school-leavers who wish to get on in industry must be apprenticed in some way by the age of sixteen years unless they are offered a student apprenticeship two years later when they leave a grammar school with certain G.C.E. 'A' qualifications. The majority of fifteen-year-olds, therefore, are faced with two major problems: the choice of a career, which in itself will determine the type of technical college course they enter; and the educational programme they should undertake in the year between school-leaving and entrance to technical college.

The choice of a career is particularly hard for a fifteen-year-old boy or girl, especially since the breakdown of older patterns of guidance whereby sons followed their fathers and daughters their mothers into the same trade or one closely similar. Today, more than at any other time hitherto, even the school-leaver of limited ability has open to him a relatively wide range of jobs, each involving some measure of vocational training within the technical college. Unfortunately, in the face of this array of choice few school-leavers possess realistic knowledge both of their own capacities and limitations or of what is implied in any given vocation. Rarely do they have even the knowledge of how to find vocational information for themselves. In any case a choice made as early as fifteen tends to be unrealistic, for, as Strong points out, of all the change which takes place in an individual's vocational interests, by far the larger occurs between the ages of fifteen and eighteen years. Stott's study, just before the second world war, demonstrated how unrealistic and impermanent are the choices made at this stage. That things have not greatly changed is shown by McGiffin who, in 1958, studied the vocational knowledge possessed by fifth and sixth-formers in two Belfast grammar schools. He found that only 18% of the pupils had adequate information about the working conditions of their chosen careers and that 59% were poorly informed, a conclusion close to that of Jahoda who states that 20% of his sample were well informed and 40% knew little beyond the name of the job. These and other similar findings point to the acute need for adequate information and guidance.

The home still exerts an important influence as has been found by Wilson, McGiffin, Jahoda and Chown working at various periods in several parts of the country and with different socio-economic groups. Even so, the replies of over 500 parents of pupils attending a secondary technical school in Essex to a questionnaire compiled by the writer for the National Foundation for Educational Research showed that parents often gave no formal advice to their children about choosing jobs; in fact, many fathers and mothers explicitly stated that they intended to leave the choice entirely to the child himself.

There are other sources of information and help open to the school-leaver before he accepts a job which leads him to technical college courses. In many areas the local youth employment officer visits each school-leaver—although Jahoda found that only one child in five accepted a job as the exclusive result of the officer's advice. This is a situation which surely needs closer study than it has received. The secondary school staff themselves also play an important role but not every school has a staff member trained and experienced in giving vocational guidance. Fewer still have one fully acquainted through attendance as a student and through careful study with the range of courses offered at technical colleges. One wonders, too, how many can and do effectively help their

school-leavers realistically to appraise their own possibilities, limitations and ambitions in terms of possible careers.

Once a job has been accepted guidance is still needed to determine the most suitable type of technical college course and here one of the most powerful influences comes from within the firm itself. Apparently, however, this is not always sound. Williams pointed out in 1957 that many personnel officers encourage their apprentices as a matter of course to enrol for national certificate courses although in J. Wilkinson's experience these normally cater for only relatively academically able students. Other students would profit more from a City and Guilds craft course, and a considerable proportion should be provided with another type of course altogether in which the academic component is the essential minimum prescribed by actual work's experience. Unfortunately, in far too many cases, the craft course is regarded as a *pis aller* suitable only for the failures of the national certificate courses; and there is little thought and less provision devoted to the third type of student.

When all these factors of inadequate individual vocational motivation and information, faulty or no help from home, school, youth employment service and firm—are taken into account it is not surprising that students accept jobs and enrol in courses for which they lack abilities, attainments and interests. If any one of these is lacking, hard work and perseverance may overcome it, but it must always be borne in mind that the education of the technical college student is mainly part-time, that even a week's absence through illness or overtime working involves an almost impossible task of catching up with his more fortunate class peers, and that this strain is imposed upon him at an age when, quite rightly, his social horizons are widening.

Students' reasons for failure

During the last decade there have been several questionnaire studies of the various reasons given by students for discontinuing their courses. A questionnaire technique has its limitations; however, it is worthwhile gathering together the conclusions which have been arrived at in this way to see what pattern emerges.

One of the earliest reports was that of MacLennan in 1948. Assessing keenness in terms of behaviour which could be observed—such as regularity of attendance, punctuality and pride in work—he found that of a group of 578, 14% were 'very keen'; 25% 'keen'; 33% 'indifferent'; 26% 'antipathetic'; and 2% 'definitely antagonistic.' When questioned about their indifference, students gave as their reason bad teaching—mentioning especially sarcasm, teachers' indifference and inappropriate teaching methods, whilst the staff attributed it to lack of intelligence and interest, and to outside distractions. MacLennan rightly emphasised that neither of these groups of reasons are penetrating enough and must be further analysed.

This has been done by several research workers. For example, Brown gave a questionnaire to groups of over 500 part-time day release students at various levels in electrical and mechanical engineering courses in two technical colleges; Stones, by a similar technique, drew his conclusions from 178 evening class students in a N.W. College of Further Education; and Boyce sent his questions to 963 students who, in 1955-56, failed to complete 75% of the course and prematurely left the Commerce Department of Cardiff

College of Technology and Commerce. In all three the main categories of reply were: interference with social activities; domestic responsibilities; dislike of the teaching methods used; work in class being too rapid; missing or rushing meals and rush to get to classes; lack of facilities for home study and poor college conditions; distance to travel to college; too tired after work to study; circumstances outside their control (which for Brown included bad weather); occupational reasons such as overtime; and in addition for Boyce, marriage; and for Brown, expensive text-books.

All three reports concluded that the most serious problem for married students, as is only to be expected, was their domestic responsibilities and Boyce adds that this is particularly important for married women, and that even for single women domestic ties were an impediment. On the other hand, one of the least important factors for married students was expensive text-books, which is perhaps rather surprising. Also of little importance for the groups as a whole was dislike of teaching methods (except where there was a particularly bad relationship between students and teacher); lack of facilities for home study; poor college conditions; and distance to travel to college, although Boyce found this to be of slight importance for younger females.

On one or two points there is some conflict of evidence. For example, Boyce found that interference with social activities was of slight importance, except for some girls, whilst Brown's group of single students, mainly men, listed it as one of their most important reasons. Again, when studying the influence of missing or rushing meals, Boyce found it to be third in importance for all students, particularly for young girls, whilst Brown found that his single students considered it to be of second least importance and his married group to be least important of all. Perhaps this may be the result of differences in distance to travel, for Stones, in asking the specific question about the rush to get to classes, discovered it to be the most important factor among all his students.

On the other hand there is general agreement as to the importance of several other factors. Work in class which is too rapid was found by both Brown and Boyce to trouble many students, especially older married ones; occupational reasons such as overtime affected mainly males, particularly the younger married ones; whilst examination reasons such as too young to sit, ineligibility to enter, or taken before the end of the course, were found by Boyce to be second in importance for all males. Again, tiredness after work was found to be a strong reason.

Under the conditions in which most technical college students do their work, the difference between success and failure may often turn on some factor which would not be of such crucial importance under the less strained conditions of grammar school VIth form and undergraduate studies. The use of libraries and books for study purposes is often of critical importance and yet a study of technical education reveals two great gaps in this respect. Recently, the National Foundation had contacts with every technical college library in this country and found some colleges either without libraries or with inadequate ones, despite the spur to improvement given by the 1956 White Paper. Again, the part-time nature of the courses tends to discourage the use of libraries. It is a natural wish on the part of students to get home and this itself is a powerful dis-incentive to search for information in the crowded conditions found in most college libraries. Many libraries, too, are not open in the evenings in any case because of lack of trained staff.

Accordingly, students have to rely upon public libraries or upon their own book purchases. No formal study is reported of the first factor, although it is common experience that public libraries are less used than they might be because students are often ignorant as to how to go about getting books from them. This problem is so urgent that some authorities, such as Hertfordshire, have instituted in their colleges a tutor-librarian system to overcome it.

It is not unnatural that technical college teachers, aware of this, should attempt to concentrate essential facts in to their actual teaching periods. This may be a contributory cause to dullness in teaching, to the feeling that a missed lecture is difficult to catch up and to the difficulty which some students have in following.

A second problem was also found to be grave by Brown who, in 1950, investigated the number and sorts of text-books owned and used by students in national certificate engineering classes in a London, a Northern and a Midlands technical college. A study of personal income and general expenditures showed that the great majority of students could at that time well afford to spend at least £1-£2 each session on text-books. He found that for the S1 and S2 groups only a minority of students owned even one book for each subject and that, in general, the level even in the examination year of S3 was a bare minimum. Accordingly, he recommended that advice be given on the purchase of books together with help in the use of books and libraries. If possible, too, the college might establish a second-hand bookstall or college hire-purchase system as occurs in some university students' unions.

Some possible lines of progress

Rewards

In a recent study Jenkinson did valuable service by pointing out that hitherto most investigations had concentrated upon reasons why students failed and that there were relatively few studies of positive methods of encouraging success. It might be assumed, for example, that financial rewards given by employers would stimulate students to perform better. In a study of this question, Stones found that the two main incentives were the desire to get better jobs and promotion. A rather surprising third place was accorded to the general educational value of the courses—unless this was a reply given to please the questioner. He also found that the reasons were given in the same order irrespective of sex, marital status or age.

In 1952, Brown made a rather more detailed study through interviews and questionnaires aimed to get students' views on the relative merits of certain incentives to study in part-time courses in a N.W. technical college near Manchester. He found that the financial rewards given by firms varied from immediate pay rate increases—from about 5/- to 10/- a week—to single cash payments of from £1-£10, and recommendations possibly leading to increased pay. These, however, were awarded only on national certificate results; and he stresses that in no case did a firm give a pay increase for even the Final City and Guilds examination. Thus, the impression that this is really an inferior examination and course was powerfully reinforced.

Of the non-financial rewards, the most coveted by students were appointments to the staff away from the factory floor. Typical reasons given for this mention signs of

improved status (such as not having to wear overalls) and later hours of starting work, and connected with both the explanation that it was possible to meet nicer girls in the headquarters block than in the factory shops.

However, one point is worth remembering; a statistically significant proportion of students did not receive a reward of any kind but yet commented favourably upon their firm allowing part-time day release for study purposes, indicating perhaps that this was reward enough.

In 1956, Brown undertook a further survey and found the results of his early work confirmed. From his questioning of part-time teachers he concludes that the main motive for obtaining certificates was to obtain money rewards, promotion and social prestige. Moreover, good students were often distinguished from the bad in that they were consciously trying to improve their standing whilst many of those who did not do well considered that their present job, such as wireman, needed no further qualifications. This last point, of course, raises educational and vocational problems of great importance and complexity.

The use of examination results for guidance

Some attempts at guidance have been made based upon sessional examination results. For example, in 1959 Hutton, basing his conclusions on students at Rotherham Technical College, considered that failure in the S1 sessional examinations reveals most of those students who cannot pass the ordinary national certificate, but he added that some lecturers consider this process of selection to be too drastic, excluding some underachievers who may later catch up with their more successful contemporaries. As a modification to meet this challenge he suggests excluding students from a course only if they fail S1 twice, or having passed S1 on the second attempt fail S2, or having passed S1 on the first occasion fail S2 twice. This could involve both a considerable loss of time and a number of failures, which are depressing to both students and staff. To avoid the experience of several failures for those who would not be likely to pass and to allow those to go forward who have a chance of passing, Hutton suggests a " border zone " procedure based upon the mark totals of the S1 examinations. He proposed in effect two ways of doing this. The first would determine a border-zone which has been found empirically to indicate about 80% of final failures and would be based on a combined maths., science and drawing result, totalling at least 131 marks, with certain minimum pass levels in each subject. Alternatively, he suggests that after a few years' experience, it should be possible to establish a border-zone the upper limit of which would cut off all certain passes and the lower all certain failures; within this would fall the doubtful borderline cases, which could then be more flexibly handled.

It might be objected that such procedures would be valid only if the S1 examination is itself valid and can be shown to be so. Hutton's work tends to support this and is itself confirmed by Jenkinson's earlier conclusion about the diagnostic value of S1 results for of 69 students who gained higher national certificates in 1952, '53 and '54 Jenkinson found that not one had failed their S1 year previously. Therefore, he too accepts an aggregate maths., science and drawing score of 139 as being a critical minimum for allowing a student to continue in an ordinary national certificate course. At the same

time, Jenkinson also concluded that the S2 had little prognostic value. In 1958 he re-affirmed these conclusions and added that S1 failures who transfer to craft courses have a high chance of succeeding. Similarly, he studied the prognostic value of S3 results for selecting higher national certificate students, noting that a pass with a total mark of 170 or above suggests success in the A2 level two years later even if the student has had to repeat some part of his course at a previous stage. Below this mark students should be advised to take alternative courses, particularly if they have failed in any one of the previous sessions, since the transition from ordinary to higher national courses involves a change to university level studies and is beyond the ceiling of some students' abilities. Alternatives for those whose success in H.N.C. is doubtful may be found in those City and Guilds courses which are open only to ordinary national certificate holders.

At this point we may pause to ask ourselves whether the kind of examination normally used at the end of technical courses at any level is—in spite of the evidence offered above —the most effective instrument of guidance. From work in the general field of educational guidance and prediction, and particularly, of course, from follow-up studies of 11-plus allocation procedures, we know that an examination of present attainment is more likely than most other measures effectively to predict future attainment in the same subject measured later by an examination of the same type.

There are two matters at issue here. The first is that of how reliable and valid such examinations are. No studies have been made specifically of these features of the S1 examinations or of the O.N.C. examinations. It seems not unlikely that they will be no more reliable than similar examinations have been found to be elsewhere and that therefore, while they will undoubtedly detect the clear-fail and clear-pass candidates, the border-zone will be uncomfortably large and the examination correspondingly difficult One is tempted to doubt whether from year to year or from college to college the limits of 131, 139 and 170 mentioned above would have the same meaning and the same predictive value. The second point is perhaps a more subtle one. Some of the agreement between S1 examinations and success later may be due to the fact that abilities having no necessary relationship to the attainment in question are called for by the way in which the examination papers are set—the ability, for example, to write connected prose, or the sheer ability to convince an examiner that one knows more than one sets down on paper. Thus, guidance based upon S1 examinations may be at once somewhat precarious, and tend to foster the kind of candidate who has a reasonable facility in answering a particular type of examination paper the structure of which has little relation to the vocation for which he is being trained.

We may finally ask whether—since the methods proposed above involve for those candidates who fail at least one year of more or less wasted effort—no better methods of guidance could be devised. Jenkinson, at the conclusion of the study just cited, in fact advocates the construction and use of attainment tests particularly in mathematics, for use in place of the current forms of S1 examinations. This would probably improve the accuracy of measurement and consequently of prediction; but it would leave the problem of time waste unsolved.

Hence, we may well ask whether, by the use of standardized psychological tests—of attainment and of ability—the guidance process cannot be started earlier and some at least

of the inevitable failure avoided by aiding students correctly to choose their courses from the outset of their career in the technical college.

The Use of Objective Tests for Guidance

This apparently simple suggestion is complicated by a large variety of factors. It has already been noted that within technical colleges there is a great range of courses and of age groups of students. A similar or even greater range is found in both the abilities of students to learn and in their levels of prior attainment, particularly in the basic subjects of English and mathematics, science and drawing. It has been found in the National Foundation's own research programme which seeks positive methods of improving guidance, that within the groups pursuing the same course were students whose abilities ranged from the top few of 'B' forms in grammar schools to the lower levels of secondary modern schools' second streams. This diversity complicates the teaching problem in two important respects—especially when it is remembered that the majority of technical college lecturers are untrained and even part-time. It restricts the type of topics which can be taught; and in any one class will be found students whose attainments are of different degrees and which have been acquired under widely different conditions in the various contributory secondary schools.

These conditions are further complicated by the part-time day release system which severely restricts the colleges' freedom of action in guiding students into levels of course appropriate to their abilities, attainments and interests. The overriding factor in streaming or grouping is not, in fact, educational or in terms of ability; it is administrative, in that the employer decides to a large extent the day on which his apprentices can be released. In addition, as Lloyd points out, there is very little time for college staff to give suitable guidance during enrolment week, the time when all students come armed with misconceptions and ignorance and seek entrance to the wide variety of kind and levels of course open to them.

Even so, it is a little surprising that in the face of this situation small use has been made of tests of ability, interests and attainments. Such group tests would at least provide an appraisal of some of the salient characteristics of students and give some indications on which to base decisions. It is not sufficient to criticise such tests as untried instruments, for under rather similar conditions in the United States, as Novak has described, there is a definite allocation of resources and time to this vital function. In any case, the levels of wastage already noted seem to reveal inadequacies in the present system underlining the need to try any reasonable guidance device.

Several colleges are at present experimenting with such standardised tests. One of the main problems is that at this stage few reports are available of their validity under technical college conditions. This problem is being examined in the research programmes of the National Foundation in several colleges in Southern England and by Venables in the Manchester and Birmingham districts. In the N.F.E.R. programme several sub-tests of a differential ability battery are showing themselves to be of value in the placement of national certificate and City and Guilds students. Venables' enquiry has gone further and suggests that by the use of objective tests the proportion of students failing ordinary national certificate courses and trade examinations can be reduced by twenty per cent.

Naturally, these two programmes have yielded results which so far are tentative rather than conclusive, but it is important that these and similar research projects be continued and reported.

Conclusion

This review of available evidence reveals high levels of wastage and withdrawal from courses in technical colleges irrespective of geographical region, type and level of course and method of organisation. Wastage is, of course, high elsewhere in our educational system, even where conditions are comparatively favourable; but it seems, for a variety of reasons, only some of which we know at present, to be particularly damaging in a sector where, everyone is agreed, we can least afford it. The Colleges have very serious problems confronting them—as anyone who has ever been present during an enrolment might well admit—and individuals and organisations within the technical colleges themselves are making very great efforts to solve them.

However, it does seem to be clear that one at least of the major points of attack—and there are a number of others—would be that of developing practical methods of guidance for students both at the transition from school to work and throughout their courses, particularly at those stages where the student has to choose whether to go on or to give up completely. It is difficult even to sketch, at the present, an adequate practical scheme since in any guidance procedures, school, college, industry, parents and the student himself would have to be closely implicated and use would have to be made of a variety of means, including examination results, objective tests of ability, aptitude and attainment, assessments of interests and of personality as well as of techniques specially devised to enable the student to take account of his own strengths and weaknesses and, in fact, to take important decisions for himself. Such a procedure, however it were devised, would take time and skill. A vocational and educational decision of such importance to a student's future is one that cannot be taken rapidly or lightly. Once this is recognised, the need to come to a decision progressively might cause repercussions on the nature of the student's first year at college. This might well become more of a year of orientation and finding out about oneself, about courses and jobs than it is at present. One would expect, too, that the present tendency for schools and technical colleges to draw closer together would be reinforced. In turn one would hope that the administrative separation between vocational guidance and educational guidance will be bridged and the close interdependence of the two recognised. In certain continental technical education institutions, such for example as the Université de Travail at Charleroi in Belgium, a member of staff specially trained in educational and vocational guidance heads a service which is responsible for guidance, general welfare and medical attention of all students. It seems likely that the costs of such a service are more than recouped in the saving of student and staff time through failure and in the less directly measurable prevention of industrial and personal maladjustment.

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Research Note:

Distribution of Methods of Teaching Arithmetic in Primary Schools in England and Wales*

by J. B. Biggs.

WHAT follows is a report on a subsidiary aspect of the N.F.E.R. study of methods of teaching arithmetic in primary schools. Full details of the plan of this project are given in the current Annual Report and will not be repeated here.

In the early stages of the enquiry a short, single page questionnaire was sent by co-operating Local Educational Authorities (61) to schools in their areas. For the purpose of the main investigation it was not necessary that the sample should be representative since the problem was one of selecting a few suitable schools which could be tested and compared. When the returns had been received, however, it became clear that the results were of interest in their own right: a large number of schools and authorities had been circulated and the data thus obtained give an interesting idea of the distribution of certain methods in the country as a whole. The aim of this note, then, is to present these data from this latter point of view.

Each headteacher was asked, in the questionnaire, to provide the following information:—

1. *General:* Type and size of school and sex of its pupils.
2. *Arithmetical Methods:* There were three questions here which asked about the school's method. Headteachers were asked specifically whether or not they used the Stern or Cuisenaire apparatus, then any definite method involving special apparatus apart from Stern and Cuisenaire. They were also asked how these methods were used—e.g. throughout the school, with backward children only, and so on. A further question concerning the length of time the method had been in use was also asked. This was of great importance for sample selection, but has no bearing on the present purpose and is therefore omitted from this analysis.
3. *Teaching Practice:* Two self-ratings were asked for concerning general practice in arithmetic teaching. The first was a five-point formality rating, ranging from 'Highly formal approach' to 'Almost entirely active methods'; and the second was also a five-point rating on use of concrete materials and project work ('A very great deal' to 'Not at all').
4. *Willingness to participate:* Of crucial importance to the research itself is the question about the willingness of the headteacher concerned to participate in a further investigation, involving testing. These responses were included in the present analysis for their intrinsic interest, rather than for any practical importance in the present context.

*The apparatus used in some of the methods mentioned in this article is described in 'Teaching Arithmetic by Concrete Analogy' by J. D. Williams in this number of Educational Research.

Over 7,000 returns were received from schools in 61 L.E.A.s. A few of these were either incorrectly or incompletely filled in and these were discarded. The resulting sample consisted of 6,995 primary schools (1,716 Infants, 1,652 Juniors, 3,448 Junior with Infant, 334 All Age and 15 Special Schools).

Before considering the details of sorting and the results, some words about the generality of the findings is necessary. Firstly, the L.E.A.s themselves were not a random sample. Of the 147 who were initially approached, 23 refused outright to co-operate and there was no reply from 33—as has been stated, the questionnaire was finally circulated amongst 61. It is likely, too, that not every school in the area of each co-operating L.E.A. was circulated and that only some subdivisions within large authorities received the questionnaire. Again, this does not matter at all from the point of view of obtaining a highly selected small sample: it would, however, restrict the generality of the present findings in that it would likewise increase the tendency to overestimate the proportion of non-traditional methods when considering the country as a whole. A rough estimation of the number of schools covered by the questionnaire, in comparison with the actual number of schools within the areas circulated, may be obtained by reference to the Ministry of Education's Statistics Returns. The total for the 61 L.E.A.s is quoted here as being 8,926 schools, almost 2,000 more than the number of questionnaires returned. It was found that the greatest discrepancies between the Ministry figures and our own returns were in the large authorities which were divided into local administrations and evidently some of these had been omitted from the circularisation of the questionnaire. However, the typicality of the sample according to school organisation can be gauged by reference to the proportions of different types of school obtained in the present sample with the Ministry figures for the whole of England and Wales:

Table I

DISTRIBUTION OF TYPES OF SCHOOL ORGANISATION

	Infants	Junior	Jun. with Inf.	All Age	N
National Figures (%)	23.9	48.8	20.1	7.1	23,615
Present Sample (%)	24.6	49.4	21.2	4.8	6,980*

*Excluding Special Schools (N = 15).

As can be seen, the sample proportions are remarkably close to the national figures, the greatest discrepancy being in the case of All Age schools. Since the policy is to close these down, it is likely that the co-operating L.E.A.s were disinclined to send the questionnaire to schools which would be unable to participate for this reason—hence the slightly higher proportions of Infant, Junior, and Junior with Infant schools in our sample.

Another limitation is concerned with the definition of non-traditional methods. This will be discussed in more detail in the next section. Briefly, the point is that it is

possible that many schools classified as using, for instance, the Stern materials, may not in fact be using the genuine article, but Stern-like material. Some heads admitted that they (*sic*) " didn't recognise them by name, but we have the blocks," i.e. they recognised material they had in their schools as being similar to the brief description of the material which was given on the questionnaire. Where it was clear, as in this instance, that the materials were not the genuine marketed article, such schools were classified as ' Miscellaneous.'

These points, then, make it unwise to take the percentages quoted here of the frequency of non-traditional methods in primary schools as being typical of the country as a whole. While the reasons given above may lead one to suspect that the sample was biassed in favour of ' progressive ' authorities and schools, it must also be remembered that the questionnaire was issued nearly two years ago, the great majority having been completed in the first three months of 1959. Many of the methods mentioned here have been rapidly gaining in popularity since then and a survey conducted now, on a similar sample, would certainly reveal much higher frequencies than those reported in the present article. Further, there are other methods which were not on the market then but which are now available such as the Shaw, Avon and Dienes materials—the last of these is in use in over 50 schools at the time of writing.

The sorting of the returned questionnaires was carried out according to the following categories:—

1. *Type:* As has been mentioned, the questionnaires were sorted into five types of school organisation: Infants, Juniors, Junior with Infants, All Age and Special.
2. *Sex:* In order to compare the use of non-traditional methods, concrete materials etc. in boys' and girls' schools, the Juniors were sorted into Boys, Girls and Mixed. However, it was found that there was no significant relationship between sex of pupils and use of materials, formality rating or type of method. Accordingly, the Boys Only and the Girls Only schools were pooled with the Mixed for all subsequent analyses. 130 Boys' schools, 105 Girls' and 1,249 Mixed schools were involved.
3. *Size:* The three major types of organisation were further sorted into school size — the relatively small numbers of All Age and Special Schools made it unnecessary to do this in their cases. An arbitrary 50 children per year group was taken as the basic unit for a ' Small ' school, two units for a ' Medium ' school and more than two for a ' Large ' school. This principle was not applicable in the case of Junior with Infants since the majority of these are small country schools with more than one year group per class so that in this case an *ad hoc* classification by size was used. The final figures, defining the ' Small ', ' Medium ' and ' Large ' groups, are contained in the brackets in Table IIA.
4. *Method:* The different methods were defined according to the following categories:
   (*a*) *Traditional.* When there was no answer, or a negative answer, to the three questions asking if Stern, Cuisenaire or ' Other ' were used in the school, that school was classified as traditional. These comprised 75% of the total sample.

(*b*) *Non-traditional Unspecified.* This consists of the schools who answered 'Yes' to the 'Other' question, but failed to describe what the method was.

(*c*) *Non-traditional Specified.* These were the schools which answered 'Yes' to the 'Other' question and gave a (usually) brief account of what the method was. When no 'Standard' non-traditional methods were mentioned, and the scheme was obviously one which had arisen in the school itself, usually with apparatus the staff had invented, these schools were classified as 'Nontrad. Spec.' Categories (*b*) and (*c*) were later pooled to form an 'Individual' method group—i.e. a non-traditional scheme individual to one school.

(*d*) *Stern.* These were simply the schools which answered 'Yes' to the Stern question.

(*e*) *Cuisenaire.* 'Yes' to the Cuisenaire question.

(*f*) *Stern and Cuisenaire.* A surprising number of schools answered 'Yes' to both the first two questions: it is therefore assumed that they operate the two schemes.

(*g*) *Ferrier.* Schools which follow Winifred Ferrier's *Real Life Number* scheme.

(*h*) *Brideoake.* Schools which follow Brideoake and Groves' *Arithmetic in Action.*

(*i*) *Montessori.* The beads and other Montessori apparatus are used.

(*j*) *Miscellaneous.* This category contains all other schemes which were individually too few to classify separately, or which incorporate standard as opposed to home-made apparatus. Under this classification come such schemes as Schiller, Dorothy Williams, Bass, Flavell, Welbent and Unifix.

Categories (*d*)–(*j*) were also pooled for some analyses and were called 'Standard' schemes. It should be emphasised that this does not imply that such schemes are rigid and standardised but that they follow, more or less, a scheme which is available to any headteachers who wish to purchase the appropriate books and apparatus. This is in contrast to the non-traditional 'Individual' category where the scheme is peculiar to a specific school.

5. *Use of Method:* The non-traditional methods were used in widely differing ways. The categories, which of course differed with school organisation, are given in Table III, together with frequencies of use.

6. *Formality Rating and Use of Concrete Materials:* These two ratings were, as has been stated, self-estimations on a five-point scale, by the headteacher. There is evidence obtained in the research study itself that such self-estimations, particularly for formality of teaching, are at best only a rough guide to the actual 'atmosphere' within the school itself. Nevertheless, as will be reported, these self-estimations were found to be related to other school characteristics, sometimes in quite a revealing way.

7. *Willingness to Participate:* There were three classes of response—willingness, unwillingness and undecided or didn't respond to this question. While this category is of more direct use to research workers, it is of general interest to see which types of school, and particularly those which were experimenting themselves with new methods, were willing to put themselves to the experimental test.

Table IIA

DISTRIBUTION OF TEACHING METHODS IN ENGLAND AND WALES

Type and size of School		Percentages of Schools using each Teaching Method										Total Numbers of Schools
		Traditional	Non-Trad U.S.	Non-Trad S.	Stern	Cuisen-aire	St. & Cuis.	Ferrier	Bride-oake	Montes-sori	Miscell.	
Infants	Small (0-99)	62	1	23	0	2	0.3	6	1	1	3	286
	Medium (100-199)	68	1	12	1	3	0.3	8	1	0.3	4	734
	Large (200+)	67	2	14	1	3	0.3	4	1	1	6	696
	Percentage over all sizes	67	2	15	1	3	0.3	6	1	1	5	
	Total numbers of schools	1,143	30	256	14	46	5	104	23	10	85	1,716
Junior	Small (0-199)	92	1	1	1	2	0	1	0	0	2	295
	Medium (200-299)	90	1	3	2	2	0.4	1	0.1	0	1	794
	Large (400+)	85	0.5	6	2	5	1	1	0	0.3	0.3	393
	Percentage over all sizes	89	1	4	2	3	0.4	1	0.1	0.1	1	
	Total number of schools	1,319	12	52	24	38	6	12	1	1	17	1,482
Junior with Infants	Small (0-99)	76	2	11	1	2	1	3	0.4	0.1	4	1,652
	Medium (100-299)	71	11	0	2	2	1	3	0.2	0.2	10	1,213
	Large (300+)	73	6	0	2	4	0.5	2	1	0	12	583
	Percentage over all sizes	73	6	5	1	2	1	3	0.4	0.1	8	
	Total numbers of schools	2,533	202	183	51	86	23	87	13	5	265	3,448
All Age	Percentage over all groups	83	1	9	2	2	0.3	3	0	0	0	
	Total numbers of schools	278	3	29	6	7	1	10	0	0	0	334
Special Schools	Percentage over all groups	47	0	27	0	27	0	0	0	0	0	
	Total number of schools	7	0	4	0	4	0	0	0	0	0	15
Totals for all types of Schools	Percentage over all groups	75	4	7	1	3	0.5	3	0.5	0.2	5	
	Total numbers of schools	5,280	247	524	95	181	35	213	37	16	367	6,995

N.B. Percentages have been rounded to the nearest whole number, except those that are 0.5% or less.

Tables IIA and IIB show the distribution of the non-traditional methods for the 6,995 schools in 61 L.E.A.s in England and Wales, according to type and size of school. It can readily be seen that the highest proportion of schools wedded to traditional methods is to be found, not surprisingly, in the Junior schools, then in the All Age schools. Special Schools appear to be the most willing to try non-traditional approaches, but the numbers are so small it would be unwise to generalise too much about practice in these. Infant schools, as one would expect, are the next most likely kind of school to try non-traditional methods. Inspection of the table shows that this is most likely to be in trying their own schemes rather than in adopting patented approaches: nevertheless, the proportion of 'standard' apparatus used is higher in the Infant Schools than in other types of organisation. The Junior with Infants, and the All Age schools fall between these two. It might be reasonable to suppose that the headteachers of All Age schools are as favourably disposed towards using non-traditional methods as are their colleagues in Junior with Infant schools, but with the 'closing down' policy, they are unable or unwilling to purchase the relatively expensive standard materials.

Table IIB

SCHOOL ORGANISATION AND TYPE OF METHOD (Summary of Table IIA)

	Traditional	Individual	Standard	Total N.
Infants	67	17	17	1,716
Juniors	89	4	7	1,482
Junior with Infants	73	11	15	3,448
All Age	83	10	7	334
Special	47	27	27	15
Total %	75	11	13	
Total No.	5,280	771	944	6,995

There are opposite tendencies with regard to non-traditional methods and size of school between the different types of school. The smaller Infants schools rely much more upon making their own apparatus than do the larger, which, apparently with larger grants, can afford to purchase the standard materials. The reverse is true with the Juniors, where it is the smaller schools which rely upon more traditional methods, while the larger ones *both* devise their own schemes *and* are prepared to purchase standard materials. There appear to be no overall differences in use of traditional methods with the Junior with Infant schools of various sizes.

Some general points emerge. Firstly, a warning might be sounded again about the interpretation of these data. The distinction between traditional and the 'individual' methods could well be a very thin one. It is entirely conceivable that a busy headteacher, not specifically using the Stern or Cuisenaire materials, would not bother to describe the scheme operating in his school; another could in fact be operating an original

Table III

USES OF NON-TRADITIONAL TEACHING METHODS

		Ind.	St.	Cuis.	St. & Cuis.	Ferrier	Other
Infants	Throughout	274	8	27	3	10	96
	Experimenting	0	1	5	0	0	0
	Illustrative	1	1	1	0	0	0
	Backward	1	1	1	0	0	2
	Unspecified	10	3	12	2	3	20
Infant Total.		286	14	46	5	104	118
Junior	Throughout	58	10	7	2	4	15
	Experimenting	0	0	6	0	2	1
	Illustrative	0	1	0	0	0	0
	Backward	6	10	21	4	4	3
	Unspecified	0	3	4	0	2	0
Junior Total		64	24	38	6	12	19
Jun. with Inf.	Throughout	292	25	38	3	19	112
	Infants only	18	3	7	4	28	54
	Junior only	2	1	2	0	1	6
	Inf. & Jun. Backward	0	4	8	0	1	11
	Experimenting	7	0	7	2	0	0
	All Backward	0	1	11	2	0	3
	Illustrative	1	0	0	1	0	0
	Unspecified	65	17	13	11	38	97
Jun. with Inf. Total.		385	51	86	23	87	283
All Age	Throughout	16	0	1	0	3	0
	Infants only	0	0	0	0	3	0
	Inf. & Jun. Backward	2	1	0	0	0	0
	Experimenting	0	0	1	0	0	0
	Unspecified	14	5	5	1	4	0
All Age Total.		32	6	7	1	10	0

Figures are actual frequencies, not percentages.

E

scheme but may hesitate to go so far as describing it as ' a definite method involving special apparatus.' In both cases their respective schools would be classed as ' traditional,' whereas a less self-critical headteacher could (and some did!) go to great lengths to describe what was evidently a traditional approach. However, one has to draw an objective line somewhere and where the head *did* go to the trouble of describing a scheme, his school was placed in the appropriate non-traditional category. The data on standard methods should be much more reliable from this point of view. Here, one can see the popularity in the Infant schools of the ' motivational ' approaches of Brideoake and Ferrier, the latter being the most popular standard approach for infants. The Junior with Infants, however, tend to adopt ' structural ' approaches, such as the Stern and Cuisenaire. A possible reason for this could be that, being more ' mathematical,' they can very readily and suitably be used by the junior and especially the backward junior children.

Table III gives a clearer idea of the uses of the methods. It can be seen that by far the greatest use in the Infants is as a whole approach (the majority of ' Unspecifieds ' are presumably also used throughout the schools only it was not explicitly stated to be the case). ' Experimenting ' refers to the method being used on trial with a limited number of children; ' Illustrative ' as a special technique for illustrating specific topics, e.g. the Cuisenaire, is well suited for lessons on fractions; ' Backwards ' means that the material is used with a few backward children only and not as general techniques with the whole class or school; ' Unspecified ' means that the headteacher omitted to state how the method was used. Additional categories were needed for Junior with Infants and All Age schools: often the method is used only in the Infant Department or sometimes with all the infants and the backward children in the junior classes. A rather strange category is the ' Junior Only ' where the non-traditional methods are employed with the juniors but not with the infants—this occurred in 12 cases.

Table IV shows the distributions and means for the self-ratings on formality. Many of the Junior with Infants (352 schools out of 3,448) and the All Ages (18 out of 334 schools) gave separate ratings for their Infant and Junior Depts: these are quoted separately. The total is made up of all separately rated *departments*, and hence the final figure is greater than the total number of schools. The extremes of the distributions are perhaps the most revealing—that, for example, as many as five Infant schools (admittedly only 0.3%) would describe themselves as ' highly formal ' and that only two Junior schools in the whole sample admit to using a thoroughgoing active approach. With the exception of All Age and Special Schools, there is a significant association between a low self-rating on formality and use of non-traditional methods. Where whole schools are compared, the Infants' headteachers see their schools as being less formal than any other type of organisation, with the exception of Special Schools, whereas Junior School heads rate their schools as the most formal. It should be pointed out that these scores are not objective estimates of formality: if they were, there would probably be far greater differences between Infants and Juniors. Thus, a ' highly formal approach ' in an Infant school, on this set of ratings, is almost certainly a good deal less formal in actual fact than a ' highly formal approach ' in a Junior school. The departments where the headteachers see their approach as less formal than any other are the

Table IV

SELF-RATINGS ON FORMALITY COMPARED WITH METHOD

	HF %	F %	M %	A %	HA %	Mean	Total No. of Schools	HF %	F %	M %	A %	HA %	Mean	Total No. of Schools
			Infants					Juniors						
Trad.	0.3	17	43	35	6	2.71	1143	3	82	14	2	0	3.85	1319
Individ.	c	13	36	42	10	2.51	286	0	61	33	5	2	3.53	64
Stand.	0.4	12	36	40	12	2.48	277	1	72	17	9	1	3.63	99
Overall %	0.3	15	40	37	8	2.64		2	80	15	2	0.1	3.82	
Total Number of Schools	5	257	688	628	128		1706	37	1185	225	33	2		1482
			Infants & Juniors					All Age						
Trad.	1	46	40	13	1	3.33	2320	2	65	28	6	0.4	3.62	265
Individ.	0	37	43	17	3	3.14	335	0	43	47	7	3	3.30	30
Stand.	1	34	41	21	3	3.09	441	0	67	24	10	0	3.57	21
Overall %	1	43	40	15	1	3.27		1	63	29	6	1	3.58	
Total Number of Schools	20	1337	1248	449	42		3096	4	199	92	19	2		316
			Infants & Juniors (Different Rating for Each Department)											
			Infant Department					Junior Department						
Trad.	1	3	48	38	9	2.50	213	3	76	16	5	0	3.77	213
Individ.	0	2	20	56	22	2.02	50	0	58	28	14	0	3.44	50
Stand.	0	1	33	48	18	2.17	89	2	62	21	12	2	3.49	89
Overall %	1	3	40	43	13	2.35		3	70	19	8	1	3.66	
Total Number of Schools	3	9	142	152	46		352	9	245	68	28	2		352
			All Age (Different Rating for Each Department)											
			Infant Department					Junior Department						
Trad.	0	8	62	8	23	2.54	13	0	69	8	23	0	3.46	13
Individ.	0	0	100	0	0	3.00	2	0	100	0	0	0	4.00	2
Stand.	0	0	100	0	0	3.00	3	0	100	0	0	0	4.00	3
Overall %	0	6	72	6	17	2.67		0	78	6	17	0	3.61	
Total Number of Schools	0	1	13	1	3		18	0	14	1	3	0		18

Table IV (cont.)

	HF %	F %	M %	A %	HA %	Mean	Total No. of Schools
Trad.	0	14	29	57	0	2.57	7
Individ.	0	0	25	75	0	2.25	4
Stand.	0	0	50	50	0	2.50	4
Overall %	0	7	33	60	0	2.47	
Total No. of Schools	0	1	5	9	0		15
	All Departments						
Trad.	1	49	33	15	2	2.32	5506
Individ.	0	30	37	27	6	2.91	823
Stand.	1	32	35	27	6	2.94	1026
Overall %	1	44	34	18	3	3.22	
Total No. of Depts.	78	3248	2482	1322	225		7355

N.B. 1. Percentages have been rounded to the nearest whole number, except those that are 0.5% or less.

2. HF = Highly formal approach;
F = Basically formal, with limited amount of active work;
M = Midway;
A = Active methods with some formal work;
HA = Almost entirely active methods.

Junior with Infants, where the Infant Department is rated separately from the Junior. In this case, it is interesting to note also that the mean rating for these Junior Departments is still a good deal lower than in Junior Only schools. This ties in with the finding from the previous section that Junior with Infants are more liable to use non-traditional methods (even where one leaves out of account those schools where they are employed in the Infants Department only), than are Junior Only schools. Of the 352 Departments in the Junior with Infant schools which were rated separately, it was surprising to find eight cases (six of which were traditional schools) where the Infant Dept. was rated to be *more* formal than the Juniors. Unfortunately, the headteachers' reasons for this were not stated (young children need more discipline. . . .?). The association between size of school and formality was tested in the case of Infants and Junior schools and it was found that there was a significant tendency for small and medium sized Infant schools to rate themselves as being more formal than large schools. In the case of Junior schools, however, there was no relationship at all between size and formality. In sum, then, one could say that Junior schools, not surprisingly, are both more traditonal and more formal than Infant schools. In both Junior with Infants and All Age schools, the Infants Departments seem to exert a moderating influence on the schools as a whole since even

where the Junior Department is rated separately from the Infant, it is still less formal than the Junior Only schools. Since many schools with both departments use non-traditional methods throughout, it is not surprising that Infant attitudes and approaches to work should pervade the Junior Departments—certainly the evidence is that any such influence is from Infant to Junior rather than *vice versa*.

More important than these bare figures, however, are the attitudes and reasons which underly them. The highly formal approach in Junior, and especially Junior Only, departments—is this due, for instance, to the formal demands of current secondary selection procedures, or to a genuine belief that a formal approach is psychologically more appropriate for older children? In the more detailed findings amongst the 87 schools in the research study itself, there were many headteachers who lamented the fact that they adopted a formal approach and would like to use more informal methods, but felt, rightly or wrongly, that by so doing that might jeopardise their children's chances in the 11+. Again, with regard to the association between formality and method, one would like to know the reasons why certain schools did adopt non-traditional methods: is this because progressive headteachers feel that these methods are more conducive to an informal school atmosphere and hence make use of them, or are these methods adopted because it is felt they are more efficient at getting the children to learn the formal techniques of arithmetic and only later does the informal 'backwash' of these methods occur? To mention the major research study once again, this last reason occurred several times in the Junior schools, and one can see a similar thing operating in the present data: those Junior schools who go to the trouble of designing their own schemes (see Table III) use them as a whole approach, while many of the standard methods, particularly the 'structural' variety, are used to help push on the backwards. These differences in approach are reflected in the formality/method distributions of the Junior schools. Unfortunately, however, the questionnaire was too short to enable one to obtain the appropriate data to provide a firmer basis to these speculations.

The headteachers' estimates of the extent to which they made use of concrete materials and project work was compared with school type and use of non-traditional methods (see Table V). These findings merely supplement those based upon formality and use of method. The mean score is the average of the five-point rating, weighting the top item as 4 units and the 'none at all' item as 0. Special schools again seem to make more use of concrete materials than any of the others: next come the Infants Only. The All Age and Junior with Infants have been divided into two categories: the first where the Infant and Junior Departments are given the same ratings and the second, where separate ratings were used, the effect in both cases was to increase the overall mean score for the whole school—another instance, perhaps, of the Infants Dept. influencing the Junior. It is interesting to note that in seven of the schools with separate ratings (five of which were traditional) the *Juniors* were said to use more concrete materials than the Infants—and again, one would like to know the rationale for this. It will be perhaps disturbing to some to note that the average Junior rating falls between the points 'not very much' and 'not at all.' The All Age mean rating is not very different from this.

The final comparison is with type of school, method and willingness to participate in the research project (Table VI). Nearly two-thirds of the total sample were willing

Table V—USE OF CONCRETE MATERIALS (Mean Scores based on five-point self-rating.)

		N	Mean of Ratings
INFANTS	Trad.	1143	2.62
	Individ.	286	2.90
	Stand.	287	2.86
Total		1716	2.71
JUNIORS	Trad.	1319	1.84
	Individ.	64	2.23
	Stand.	99	2.05
Total		1482	1.87
JUNIOR WITH INFANTS*	Trad.	2398	2.12
	Individ.	338	2.30
	Stand.	469	2.32
Total		3205	2.17
JUNIOR WITH INFANTS†	Trad.	135	2.33
	Individ.	47	2.49
	Stand.	61	2.51
Total		243	2.41
ALL AGES*	Trad.	273	1.96
	Individ.	30	2.23
	Stand.	22	2.09
Total		325	1.99
ALL AGES†	Trad.	5	2.10
	Individ.	2	2.75
	Stand.	2	2.75
Total		9	2.50
SPECIAL SCHOOLS	Trad.	7	3.00
	Individ.	4	3.50
	Stand.	4	3.00
Total		15	3.13

* Both Departments same rating

† Each Department different rating.

to do so, and considering the fact that the details of the proposed study supplied to the headteachers were minimal, this must be considered as a very encouraging response and perhaps an indication of the general concern about the state of arithmetic teaching. This unease is probably at its strongest in the Junior school, which is where the highest proportion of agreement to take part was found. One can readily understand the reluctance of Special School headteachers to participate and possibly many All Age school heads felt that, with the prospect of closing down, there would be little point in agreeing to any research in their schools. When analysed according to school size and type of method (these data are not included in table form) it was found that non-traditional schools whether individual or standard, were significantly more willing to participate than traditional schools—especially in Junior Only schools. Also, size of school was significantly related to willingness—possibly because the large schools were conveniently situated in an urban locality and had the means to try out standard methods and wished to have them evaluated. In large Junior schools using non-traditional methods, the proportion willing to participate was as high as 85%.

Table VI

WILLINGNESS TO PARTICIPATE IN RESEARCH

		Yes	No	?
Infants	%	61	32	7
	N	1048	542	126
Juniors	%	67	28	5
	N	987	415	80
Junior with Infant	%	58	34	8
	N	2012	1176	260
All Age	%	50	41	9
	N	168	137	29
Special	%	40	53	7
	N	6	8	1
Total	%	60	33	7
	N	4221	2278	496

Conclusions

Bearing in mind the limitations of this survey in terms of possible initial biasses of the sample and of the lapse of time since the questionnaire had been issued, these results have nevertheless some importance. Unfortunately there was insufficient time to look at all the possible interactions and combinations of data—for example, whether or not schools using non-traditional methods with backward children only are more formal than equivalent schools who use them throughout. The various combinations of the variables are virtually limitless and, generally speaking, the findings presented here are restricted to direct associations with use of method and the other variables. The questionnaire was (necessarily) brief and it possibly raises more questions than it answers: those that it does answer are mostly self-evident, such as the higher frequency of non-traditional methods in Infant schools or departments. The really important question—whether in fact these non-traditional methods are more effective than traditional methods in Infant, Junior or both departments—remains of course outside the scope of this part of the enquiry. It is hoped that the major research project will throw some light on this question.

The present data consistently throw up differences between Infant and Junior school practice: it is not possible to say whether this difference is due to outside circumstances or to a belief that juniors *need* sound drilling in formal work, for which purposes traditional methods are probably as good as any. The apparent concern for arithmetic teaching, illustrated by the keen desire of Junior heads to take part in research, coupled with the fact that in those parts of the country such as Leicestershire, where there are some areas which do not have a selection examination at 11+ and where the Junior schools follow the Infant schools with respect to lack of formality, use of non-traditional methods and so forth—these points collectively suggest that Junior headteachers would like to make more use of non-traditional methods than they in fact do. It is perhaps significant too that where Infant and Junior Departments are in the same school, it seems that Infant practice is more likely to modify the approach in the Junior Department, than Junior methods to ' toughen up ' the infants. In a report on the 1955 National Survey, Pidgeon (1959) states that when the appropriate allowances are made for environmental factors, there is " some indication that the performance of the children in combined Junior with Infants schools is superior " (see also Table VIII in the same article). There is then, some objective evidence that this tendency of modifying the Junior approach does in fact pay. Certainly there are excellent *a priori* reasons why there should be at least continuity between the two departments (see, for example, Pidgeon, *op. cit.*).

Some may consider it surprising that as *many* as one-quarter of the total sample made use of non-traditional methods. In view of the current concern with arithmetic and mathematics teaching, and of the present availability of even more radical attempts to allay this concern, a further survey, with perhaps a more detailed questionnaire, would provide some very interesting comparisons with the present findings—the author's guess would be that, allowing for the bias in the present sample, the proportions would be probably a good deal higher than the one-quarter reported here.

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Ministry of Education Statistics Return, No. 8, 1959: H.M.S.O.
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Research Note:

ATTENDANCE THROUGH THE SCHOOL YEAR

by FRANK SANDON,
(formerly Headmaster, Millom School, Cumberland)

Fluctuations in Attendance

RECOGNISED schools are required by the Ministry of Education Regulations to keep attendance registers for each session to show the presence or absence of each pupil. The pupil is required by law to be present. The most commonly accepted reason for absence is sickness, though absence in order to spend holidays with parents is also recognised. In the very great majority of cases sickness is given as the cause of absence, though this is not necessarily substantiated by a doctor's certificate.

A knowledge of the pupil's reaction to the requirements is clearly desirable in any discussion about a change in the arrangements of terms or in the dates of annual examinations.

In an earlier enquiry*, it was found that there was an increase during the week in the number of absences, those at the end of a week being some 25% more than those at the beginning. The true sickness incidence could hardly account for this, and it was suggested that psychological reasons for absence must be considered. Is there something of the same feature in evidence through the term or the year? An analysis of absence must clearly be by averages over a number of years, as an epidemic can easily distort the

Months	N.H.I. Sickness Claims (in thousands)	Average Percentage Absence			
		City Schools		Country Grammar School	
		Primary	Grammar	Whole School	5th Form
	a	*b*	*c*	*d*	*e*
Sept.	121.7	7.8	4·5	4.2	6.6
Oct.	147.6	8.1	4·7	4·9	5.8
Nov.	155·3	10.0	5.1	5.1	6.2
Dec.	139.2	11.7	6.4	6.1	8.5
Jan.	212.0	11.7	7.0	9·7	10.7
Feb.	204.8	13·5	7·7	5·7	8.4
March	175.0	11.3	6.2	7·3	6.8
April	131.2	8.9	4.6	5.1 3.9	8.3 3·3
May	126.8			4·9	4·7
June	112.6	9.8	7.1	5·3	3·5
July	100.3	11.3	7.2	5.8	7·4
Aug.	95.8	—	—	—	—

*Sandon, Frank: "Absence and Recovery recorded at Irregular Intervals, illustrated by School Data," *Biometrika*, XXIX (III and IV), 336-349, 1938.

routine run of the annual sickness incidence (the influenza epidemic of 1957 trebled the ordinary number of claims for National Health Sickness Benefit, and was so marked a feature that even over several years the averages are not smoothed out; this year is not included when we average later on). The figures given in the Table and referred to in the following analysis are all based on the averages of a number of years.

The Annual Cycle of Adult Sickness

The first column (*a*) gives the annual number of N.H. Sickness Benefit claims. It will be seen that there is an annual cycle, with a maximum in January and a minimum in August. The December sickness figures are anomalous, those for October, November and January all being greater (the number of *deaths* rises steadily from October to January): the sickness is probably not reported on the same basis as in the other months—the approach of Christmas tends to keep folk at work to get their spending money. The figures on which this column is based relate to adults, and cannot be assumed to apply precisely to children, but they seem to give a fair indication of the way in which children's health may vary throughout the year.

The Annual Cycle for School Absence

In a large Midland city the Welfare Officers have for many years tabulated figures for something like ten thousand grammar school pupils currently on roll and for about ten times as many primary school pupils. The resulting figures averaged over a number of years are shown in columns *b* and *c* of the Table. Because of the wandering date of Easter, the April and May figures have been recorded together. We see that on the whole these figures follow the same pattern as the N.H. sickness claims. The primary schools show over half as much absence again as do the grammar schools, and they fluctuate over a wider range—primary schools 5.7% (from 7.8% to 13.5%); grammar schools, 3.2% (from 4.5% to 7.7%). The worst term from the point of view of attendance is the Lent Term. The figures are: *Primary:* Autumn, 9.34%, Lent, 12.21%; Summer, 9.70%; *Grammar:* Autumn, 5.10%; Lent, 6.74%; Summer, 5.99%: in this we have counted all the April figures in with those of the Summer Term.

In the Summer Term, we note that, instead of a fall at the end of the term, as would be expected from the N.H. figures, there is an increase. In some schools, pupils are allowed to stay at home for private study when their form is taking an examination in which they are not involved. The practice about marking these absences is not consistent, but they are not likely to have much effect on the percentage absence figures. The increase may be due to parents' holidays, and it seems desirable to check for this if possible.

Parents' Holidays as a Cause of Absence.

For this we use data from a little country grammar school. Here the records could be checked by the personal knowledge that there were practically no cases of parents' holidays causing any loss of school time; nearly all the holidays were taken in the local industrial holiday period, which occurred outside school terms. The total absence figures considered over ten years were less than ten thousand per month, so that (apart entirely

from fluctuations due to epidemics) the random monthly fluctuations are wider than those for columns *b* and *c*. But the general picture is clear (col. *d*). And here we have the further advantage that we can consider the pre-Easter and the post-Easter April figures separately. Even for this school, we see that there is a rise at the end of the summer term. So rather than seek an explanation for absence in holidays with parents, we must look elsewhere. It seems as if there is some other reason for absence, some loss of keenness on regular attendance as the term wanes just as there was in the case of the week. What is the effect of end of term examinations on attendance? Can we isolate this to any degree from other causes?

Examinations as a Cause of Absence

At the grammar school just mentioned, the Fifth form figures were reviewed for a number of years. For such a small school the total monthly absences considered in any one month were all less than a thousand, so that the average percentage attendance figures (col. *e*) can only be taken as a rather vague indication of the general tendency. Rather surprisingly, the attendance of the Fifth Form was, in general, poorer than that of the rest of the school. The absences of this form fell when examinations were pending, but at the end of the Lent Term (as soon as the ' Mock Examination ' was over) and at the end of the Summer Term (as soon as the External Examination was over) absences increased. The discrepancy between the pre-Easter (8.3%) and the post-Easter (3.3%) April figures is most remarkable.

Weather as a Cause of Absence

There is another feature that is worthy of comment. Whereas columns *a*, *d* and *e* put the maximum in January, columns *b* and *c* put it as February. In the case of *d* and *e* it is known that for January there is an exceptional number of absences due to weather conditions—as many as 50% of the school have been snowed up at times in this month, which shows this phenomenon most pronouncedly. So perhaps the maximum sickness occurs in February for children and in January for adults. There may be an alternative explanation; the N.H. sickness claims may be swollen because of an attitude of the claimants related to that which we saw contributed to the abnormally low December claims.

Summary

In the foregoing analysis the main conclusions that seem to be demonstrated by our figures are:—

(*a*) Most of the absences in recognised schools are due to genuine sickness.

(*b*) The annual cycle for children's sickness follows closely that for adults.

(*c*) The worst term for attendance is the Lent Term, and the worst month is, in general, February.

(*d*) Primary school children are more prone to absence than are grammar school pupils.

(*e*) Pupils' attendance at school tends to be better when they are due for important examinations.

(*f*) There is, however, a tendency to be more casual about regular attendance towards the end of each term and certainly towards the end of each school year.

Note:

It will be observed that we have throughout worked in respect of absence and not of attendance. The latter is more usual in school statistics, but as its percentage usually runs at something in the nineties it does not give immediately such a clear impression of the changes as does that of absence. Where the latter is required as a regular return, it is convenient to use a nomogram. We can prepare a suitable one as follows.

If N is the Number on Roll, and a the absences (or, of course, if a is the sum of absences over a period and N is the sum of the absences and attendances over the same period), then p, the percentage absence, is, of course, $100a/N$. The nomogram can readily be prepared on school quadrille-ruled (graph) paper, with three equal vertical straight lines. On the left hand side AB is graduated logarithmically from 1 at the bottom to 10 at the top. On the right hand side CD is graduated logarithmically from 1 at the top to 10 at the bottom. Midway between these two EF is graduated logarithmically from 1 at the bottom to 100 at the top. A ruler (preferably transparent) placed for the value of a on AB to the value of N on CD will give the value of p on EF. The decimal points can be neglected but allowed for at the end.

A neat sufficiently large nomogram already ruled will be found as Fig. 1 in '*Nomograms*,' by C.V. Gregg (1s.2d. from Mathematical Pie, Ltd., 97 Chequers Road, Doncaster). This gives p by the use of the equivalent formula $Np = 100\ a$, by reading for x the value of N, for y the value of p and for z the value of a, and, as before, allowing at the end for the correct position of the decimal point.

Abstract:

REGULARIZED ENGLISH

by Axel Wijk

An Investigation into the English Spelling Reform Problem with a New, Detailed Plan for a Possible Solution.

Stockholm Studies in English, VII.
Published Almqvist and Wiksell, Stockholm, 1959.

I. Introduction

DR. Wijk reviews previous plans for spelling reform which have been more or less based on the idea of having a particular symbol to stand for one sound only and letting each sound be represented by the same symbol. Such proposals for reform have never had much success and there seems little prospect that they will be accepted. He proposes his own system, to be called Regularized English, which has the following advantages:

(*a*) It does away with most irregular spellings.
(*b*) It retains present spellings in 71% of running words on an average page and thus preserves a high degree of continuity between present and proposed systems.
(*c*) It preserves etymological connections between English, Romance and Teutonic languages.
(*d*) It retains distinctions between spelling in homonyms.

II. The Main Proposals

(*a*) All the present sound symbols should be preserved in their regular, i.e. most frequent, usages. We should reject the idea of a strictly phonetic spelling and allow certain speech sounds to be represented by more than one symbol. Dr. Wijk also lays down rules restricting the situations in which certain combinations of letters can have more than one pronunciation. The only symbol which is not used at all in the system is 'ph.'

(*b*) Irregular Spellings should as far as possible be replaced by regular ones in accordance with rules already inherent in the present orthography. Thus practically all new spellings become self-explanatory. The regularity and irregularity of spellings should be decided by a thorough statistical examination of the way in which existing sound symbols are used in the present orthography.

(*c*) No new vowel symbols have been introduced but the use of 'aa' and 'oe' has been much extended. The symbol 'aa,' for example, has been consistently used for the sound 'a:' when this is not followed by 'r.' Thus 'father,' 'drama' etc. become 'faadher,' 'draama,' etc.

(*d*) One entirely new symbol ' dh ' is introduced for ' th ' (voiced) in medial and final positions.

(*e*) Voiced ' s ' is written ' z ' except in the plural and genitive ending of nouns and the third person singular of verbs.

(*f*) The silent ' e ' finally has been preserved where the vowel is long, added where a word ends in two consonants and is preceded by a simple regularly long vowel (' childe,' ' pinte,' ' moste,' etc.) and omitted where a simple short vowel is followed by a single consonant, as in ' hav,' ' liv,' ' giv,' etc. It is also used to indicate the soft pronunciation of a preceding ' c ' or ' g '.

One reason for the conservatism of Dr. Wijk's reforms is that he makes use of existing orthographical rules to the fullest extent. In present orthography the difference between the so-called long and short sounds for a, e, i (y), o and u is made clear by the spelling of the word which has often evolved according to definite rules. Therefore no different symbols are needed for long and short vowels. For example, Dr. Wijk distinguishes eight categories of words in which short pronunciation of a simple vowel not before ' r ' occurs and eight categories in which the long pronunciation of a simple vowel not before ' r ' is mainly found. There is a difficulty, however, with words in which the stress falls on the second syllable from the end when the word is followed by a single consonant only, and no definite rules are cited for these except to indicate a short vowel sound by doubling the medial consonant in those words in which a change has been made for some other reason such as ' reddy,' ' hunney,' ' nurrish,' etc.

III. The Necessity for Reform

Dr. Wijk makes a survey of the major works on orthography from 1568 to the present day. He deals in great detail with the reform proposals of the British Simplified Spelling Society and the American Simplified Spelling Board to which he objects primarily on the grounds that 90% or more of the language would be altered in spelling. Some sort of reform, however, is essential for the following reasons:

(*a*) The view that it takes an English-speaking child " from one to two years longer to learn to read and write his language than it takes children of other nations to achieve comparable results in their languages."

(*b*) The convenience of having children learn to read by using rules instead of relying on eye-memory.

(*c*) The fact that the difficulty of English spelling places a false value on spelling ability.

(*d*) The evidence for backwardness in reading. This is cited from the Ministry of Education Pamphlet No. 18; 30% of all 15 year olds have reading ages more than 20% below their chronological ages.

(*e*) The difficulty that foreign students of English have with English pronunciation and orthography.

IV. The Way in which Regularized English could be Introduced

(*a*) A long transitional period should be allowed during which children learned to read and write Regularized English before passing on to traditional English.

This should last for at least twenty or thirty years. When they reach the third year children should be taught to read traditional English but not to write it.

(*b*) The older generation, except for teachers, should be left in peace. It is essential to secure the co-operation of teachers. They are in a good position to realize the shortcomings of the present system.

(*c*) Dr. Wijk recommends English as the principal international auxiliary language and suggests that foreign nations could reform English spelling without waiting for English speaking peoples to accept the reform although Regularized English is designed principally for the benefit of the native speaker.

V. Part II of the book is a detailed application of the general principles to the various vowel and consonant symbols as they occur in different positions.

VI. Abstractor's Comments

The many advantages of this system have been clearly stated by Dr. Wijk, together with some disadvantages. Among further possible disadvantages the following points may be considered:

(*a*) Many difficulties of orthography still remain, particularly with regard to unstressed vowels.

(*b*) No pilot experiment has been carried out to discover whether Regularized English is as time-saving in schools as it is claimed to be.

Example:

Lincoln's Gettysburg Speech.

Foarscore and seven years ago our faadhers braught forth on this continent a new nation, conceevd in liberty, and dedicated to the propozition that aul men ar created equol.

Now we ar engaged in a greit civil wor, testing whedher that nation, or eny nation so conceevd and so dedicated, can long endure. We ar met on a greit battlefield ov that wor. We hav cum to dedicate a portion ov that field az a final resting-place for thoze hoo here gave their lives that that nation might liv. It iz aultogedher fitting and proper that we shood doo this.

A new publication:—

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E. A. LUNZER, M.A., Ph.D.

University of Manchester.

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SOCIAL STRUCTURE, LANGUAGE AND LEARNING

by Basil Bernstein, *University College, London.*

NO one in his right mind would plan an educational programme without taking into account the age of the pupils, their levels of maturity, intellectual and emotional, their interests and, of course, their social background. However, the extent to which we take account of these factors varies, and of equal importance is *how* we take account of them. It is the contention of this paper that we have failed to think through systematically the relationship between the pupil's background and the educational measures appropriate to successful learning. This is not say that we have no information. Many researches have shown a relationship between a bit of the child and a bit of education. Often the teacher and the researcher is the same person at a later point in time but it seems that we are still engaged on psychological or sociological matching.

Although training colleges are aware of the importance of the pupil's social background and sociology is accepted as an important part of teacher training, there is little sign that an educational programme has been systematically thought through for the pupil whose origins are lower working class—approximately 29% of the population. This does not mean that we do not possess an armoury of visual aids, folk dancing, guitar playing, or text books for the slow but 'normal' learner. The teacher does not lack advice on problems of discipline, from the suggestion that 'louts should teach louts' to *From Innocence to Experience: without the aid of the cane.* Some think it is simply a matter of class-size but fail to see that it may be a question of which sized class for which particular group of normal children. A few pieces of contemporary research have indicated that it is equivocal to suggest that size of class matters; and yet we have no criterion by which to judge what constitutes a significant difference in size. Is it a drop in number from forty to thirty or a reduction to fifteen? Is it perhaps of greater importance whether the pupils come from the middle or lower working-class?

The general problems involved in teaching children from the lower working-class relative to those from the middle-class, are not necessarily problems of teaching children who differ in an innate capacity to learn as indicated by tests of intelligence. In fact, the evidence indicates that there must be a greater absolute number of children with very high intelligence in the lower than in the higher social groups.* What is of greater interest, is that there appears to be in different social groups a particular and different relationship between scores on group verbal and non-verbal tests, (for example, the Mill Hill Vocabulary Test and Raven's Progressive Matrices). In lower working-class groups the verbal scores are grossly depressed in relation to the scores at the higher levels of the non-verbal test. The scores on the verbal test of the majority of children from this group tend to fall within the average range of the test whilst the scores on the non-verbal test tend to yield a normal curve of distribution skewed to the right, that is, in the direction of the highest scores.

* The statement refers to the *total* number of manual workers (the customary working-class group) *not* to the lower working-class considered as a sub-group.

Educational performance as judged by attainment in class is related to the scores on the group verbal test. A fairly consistent pattern emerges which reveals that as the boys' scores move towards the highest points possible on the non-verbal test the gap between the scores on the two types of test widens. As the present writer found, differences here are of the order of 20 + I.Q. points. In a sample of pupils attending a famous Public school this relationship, found in the working-class, was not present. The depressed scores on the verbal test for those working-class boys who have very high non-verbal scores, could be expected in terms of the linguistic deprivation experienced in their social background. This raises the question of the relationships between potential and developed intelligence and education.

In the light of what we know from much research, we can suggest a pattern of difficulties which the lower working-class pupil experiences in trying to cope with education as it is given in our schools. This will not hold in precise detail for every pupil, but we can say that the probability of finding such a pattern is greater if the pupil's origin is lower working-class.

Such children will experience difficulty in learning to read, in extending their vocabulary, and in learning to use a wide range of formal possibilities for the organisation of verbal meaning; their reading and writing will be slow and will tend to be associated with a concrete, activity-dominated, content; their powers of verbal comprehension will be limited; grammar and syntax will pass them by; the propositions they use will suffer from a large measure of dislocation; their verbal planning function will be restricted; their thinking will tend to be rigid—the number of new relationships available to them will be very limited.

In arithmetic they may master the mechanical operations involved in addition, subtraction and multiplication, provided they have also mastered their tables, but they will have some difficulty in division. However, verbal problems based upon these operations may confuse them. They will have great difficulty in ordering the verbal argument before applying the operations. They will tend to learn a particular set of operations in relation to a discrete context and they will have difficulty in generalising the operations to a wide range of contexts. Their conception of number will be restricted. As the progression shifts from the mechanical application of fractions and simple percentages to relatively more sophisticated expressions, their lack of understanding of arithmetical *processes* will be revealed. Ratio may well be a point in the gradient of difficulty which they are unable to pass. As they develop, failure in their basic understanding will limit what they can do despite persistence and application.

Their time-span of attention will be brief and this will create the problem of holding and sustaining attention. They are not interested in following the detailed implications of a concept or object and the matrix of relationships which this involves; rather they are disposed towards a cursory examination of a series of different things. Their interest in *processes*, even those which are linked to their everyday experience, is limited. As soon as the formal dimension of the process is reached they begin to be uneasy. The interval between feeling and doing is short and this facilitates the acting out of impulse behaviour. Their curiosity is limited which removes an important dynamic from learning. They tend to require a very clear-cut educational experience with little ambiguity in direction

and content. They are highly suspicious of anything which does not look like education as they traditionally conceive it. In the *short run* democratic appeals are less successful than dictatorial edicts.

Although the pupil may pass the primary stage without a great sense of unease, the discrepancy between what he is called upon to do and what he can do widens considerably at the secondary level. The character of the educational process changes at this level. It becomes increasingly analytic and relies on the progressive exploitation of what Piaget calls *formal* operations, whereas lower working-class pupils are more likely to be restricted to *concrete* operations. Finally, and with somewhat less confidence, we may say that there is a general flatness in their over-all educational achievements in the basic subjects. Although there may be one or two small peaks, in the main such pupils are confined to the average level. It is, I suggest, a peculiarly undifferentiated educational performance.

No mention has been made—deliberately—of the reduced motivation to learn, of the lack of involvement in the means and ends of education, of the standardised reactions, which are an unhappy defence against the despair and failure which school symbolises, and of the problems of discipline which are so generated. The central problem for the lower working-class child is, primarily, that of learning *how* to learn and secondly, that of learning *what* has to be learned. To make the educational experience happy and contented is not necessarily to solve the problems of learning, if this is achieved by by-passing the problem and playing directly into a concrete perceptual set—as is done by much use of visual and concrete material. Sometimes class control is considered as a substitute, instead of as a condition, for learning. The problem however is *not* how to get the pupil interested but what to do *after* his interest has been elicited.

There is, of course, a wide range of individual differences and, it must be expected, such patterns will not be found with all children of the particular social background under discussion; nor are they confined to such pupils; it is suggested, however, that there is a higher expectation of finding this pattern of educational performance with the social group mentioned than with others.

How does this happen? What is the most important single factor in a boy's history, which generates this consistency of emotional and intellectual behaviour in the learning situation? It is not good enough to say that he thinks descriptively and is insensitive to abstract formulations, that he is concerned with substance rather than process, or, on a more sociological level, that there exists a clash in values between the school and the home, that the orientation of education is middle-class. These, and many others, are descriptive statements, which describe differences between some part of the boy and some part of the school. The question raised here is a dynamic one. How does the boy become like this and what is the main agency through which this becoming is facilitated and reinforced?

I suggest that forms of spoken language induce in their learning, orientations to particular orders of learning, and condition different dimensions of relevance. Teachers, research workers and educationalists have all commented on the limited linguistic skill and vocabulary of lower working-class pupils and the difficulty of sustaining and eliciting adequate communication.

It is therefore not new to focus upon the use of language as judged by educational criteria. Nisbet thought that part of the negative correlation between family size and I.Q. was the result of the type of speech model made available to the child. He considered that this linguistic limitation effected in some way a general cognitive impoverishment. Mitchell (on the basis of an analysis of a battery of tests given to children of high and low social status), found that the verbal meaning and fluency scores for the low-status children could be used to predict their scores on a range of different factors. In this group there was a lack of differentiation among a number of functions whereas for the high-status group there was considerable differentiation. Studies reported by McCarthy, of children in the special environments of residential institutions, indicate that they suffer a grave language deficiency and that their powers of abstraction are often impaired.

Luria and Yudovitch recently studied identical twins who were grossly retarded in speech for non-organic reasons. The twins were subjected to experimental changes in their environment and the speech changes subsequent to this were noted. It was found that the twin who had received special language training was able to perform more efficiently upon his environment, through the development of discursive operations which were not available to the twin who had received no training and who served as a control. These studies and others point to the critical role of spoken language in the process by which the developing child achieves self-regulation. Of particular interest, is the relationship between forms of spoken language and the mode of self-regulation. It is the nature of this inter-relation I want to consider and its educational implications.

There is little doubt that the social form of a relationship acts selectively on the mode and content of the communication. The language of the child in a group of other children (as shown by the Opies) is very different in structure and content from that he uses when speaking to an adult. Similarly the spoken language of combat units in the armed services is different from that normally used in civilian life. Vigotsky maintained that the more the subject of a dialogue was held in common, the more probable is it that the speech will be condensed and abbreviated, for example we may think of the communication pattern between a married couple of long standing or that between old friends. In these relationships, meaning does not have to be made fully explicit; a slight shift of pitch and stress, a small gesture can convey a complex meaning. Communication goes forward against a backcloth of closely shared identifications and affective empathy which removes the need for elaborate verbal expression.

This communion of the spirit which underlies and conditions the form of the communication may render what is actually said, gravely misleading to an observer who does not share the history of the relationship. The *how* of the communication is heavily burdened with implicit meanings. Some of the verbal meanings are restricted and not elaborated. The observer will be struck by the measure of his own exclusion and this will be reinforced by the expressive intimacy, vitality and warmth which accompanies what is said. The content is likely to be concrete and descriptive rather than analytical and abstract. The backcloth of closely shared identifications which create empathy gives to the speech sequences, from the point of view of the observer, a large measure of dislocation. The dialogue appears somewhat disjunctive because of the logical breaks which interrupt the flow of information.

What is the effect on behaviour if this form of spoken language is the *only* one which individuals have at their disposal? What are the implications if individuals are unused to signalling meaning unless it is against a background of common and closely held identification whose nature has rarely, if ever, been verbally elaborated and made explicit? What is the result of learning to operate with restricted speech structures where the burden of meaning may lie not so much in what is said, but how it is said, where language is used *not* to signal and symbolise, fairly explicitly, individual separateness and difference but to increase consensus? This does not mean that no disagreements will take place. What does it mean, in terms of verbal conceptual growth, if speech is only, or mainly, used in circumstances where the intent of the other person may be taken for granted and no pressure induces the need to create speech specially to fit the needs of those outside the group who do not share its experience? Where the number of situations which serve as stimuli for verbalisation is restricted by the conditions and form of the social relationship?

It is suggested that this is the situation in which many children of the lower working-class grow up. Their society is *limited* to a form of spoken language in which complex verbal procedures are made irrelevant by the system of non-verbal, closely shared, identifications which serve as a backcloth to the speech. The form of the social relationship acts selectively on language potential. Verbalisation is limited and organised by means of a narrow range of formal possibilities. These restricted formal strategies, for the sustained organisation of verbal meaning, are capable of solving a comparatively small number of linguistic problems, yet, for this social group they are the *only* means of solving all and every verbal problem requiring a sustained response. It is not a question of *vocabulary*: it is a matter of the *means* available for the organisation of meaning and these means are a function of a *special type of social relationship*. The size of the vocabulary is a function of other variables as will be shown: it is a symptom but not a cause of the speech form, although, in its own right it acts as a reinforcing agency.

The linguistic relationship between the lower working-class mother and her child is such that little pressure is placed upon the child to verbalise in a way which signals and symbolises his unique experience. The 'I' of the mother, the way she organises and qualifies her experience, will be transmitted to the child *not* through evoking speech which is specially cut for this purpose. Spoken language is *not* perceived as a major vehicle for presenting to others inner states of the speaker. What can be said is limited by the rigid and limited possibilities for verbal organisation. It is a combination of non-verbal signals with a particular structure of verbal signals which originally elicits, and later reinforces, a preference in the child for a special type of social relationship, which is limited in terms of verbal explicitness and relies heavily on a pattern of non-verbal signals. The 'I' of the lower working-class mother is not, relatively, a verbally differentiated 'I.'

The shift of emphasis from non-verbal to verbal signals, in the middle-class mother-child relationship, occurs earlier and the pattern of the verbal signals is far more elaborate (Bernstein 1961). Inherent in the middle-class linguistic relationship is a pressure to verbalise feeling in a relatively individual manner and this process is guided by a speech model which regularly and consistently makes available to the child the formal means whereby this process is facilitated.

It can be said that for the middle-class child there is a progressive development towards verbalising and making explicit, subjective intent, whilst this is *not* the case for the working-class child. This is not necessarily the result of a deficiency of intelligence but comes about as a *consequence* of the social relationship acting through the linguistic medium. It is through this developing medium that the child learns to internalise his social structure. His environment, and what is significant in his environment, is taken into himself, to become the sub-stratum of his consciousness by means of linguistic processing. And every time he speaks, his social structure is selectively reinforced. This does not deny the role of non-verbal learning but I suggest that even here, from an early age, the effects are fed through language and are stabilised by language. As speech marks out a pattern of stimuli to which the child adapts in the learning of this pattern, his perception is organised, structured and reinforced. The adequacy of his response is rewarded or punished by the adult model until the child is able to regulate his responses independen tly of the adult. In this way the outside gets into the inside from the very beginnings of speech. The appropriateness of the child's behaviour is thus conditioned to a wide variety of contexts by means of the vehicle of communication.

The lower working-class child learns a form of language which symbolises the normative arrangements of a local group rather than the individuated experience of each of its members. The form of the communication reinforces the pattern of social relationships but fails to induce in the child a need to create speech which uniquely fits his experience. Luria has suggested that speech may be considered as a complex of additional signals which leads to marked changes in the field of stimuli. It isolates, abstracts and generalises perceived signals and relates them to certain categories. Speech becomes a major means of selectively reinforcing perceptions. In the context of this discussion, forms of spoken language mark out what is relevant affectively, cognitively and socially and *experience is transformed by that which is made relevant.*

What is made relevant by the form of lower working-class speech is markedly different from that which is made relevant by the form of middle-class speech. The experience of children from these gross strata follows different paths from the very beginnings of speech. The type of learning, the conditions of learning and the dimensions of relevance initiated and sustained by the spoken language are completely different. In fact, it would not be too much to say that in strategic respects they are antithetical. The behaviour of the children is regulated according to separate and distinct principles. They have learned two different forms of spoken language; the only thing they have in common is that the words are English.

At this point a rather more rigorous definition is necessary of the two linguistic forms which, it is suggested, become the major instruments initiating and sustaining the socialisation process. The linguistic forms associated with the lower working-class I shall call a *public* language. Here it should be remembered that there will not be a one to one relationship between the lower working-class and this form of spoken language but the probability of its use is certainly very high. With this in mind, we may dispense with social class concepts and refer to types of spoken language and the behaviour sustained by them. Operationally, it is more accurate to use the linguistic forms to distinguish the groups rather than a particular class affiliation.

A *public* language is a form of language use which can be marked off from other forms by the rigidity of its syntax and the restricted use of formal possibilities for verbal organisation. It is a form of relatively condensed speech in which certain *meanings* are restricted and the possibility of elaboration reduced. In this case speech* does not become the object of special perceptual activity, neither is a theoretical attitude adopted to sentence organisation. Whilst it may not be possible to predict any one content of this language, the formal organisation and syntax is predictable for any one individual. The class of the content is also predictable. The characteristics of a *public* language are as follows:

1. Short, grammatically simple, often unfinished sentences with a poor syntactical form stressing the active voice.
2. Simple and repetitive use of conjunctions (so, then, because).
3. Little use of subordinate clauses to break down the initial categories of the dominant subject.
4. Inability to hold a formal subject through a speech sequence; thus a dislocated informational content is facilitated.
5. Rigid and limited use of adjectives and adverbs.
6. Infrequent use of impersonal pronouns as subjects of conditional clauses.
7. Frequent use of statements where the reason and conclusion are confounded to produce a categoric statement.
8. A large number of statements/phrases which signal a requirement for the previous speech sequence to be reinforced: " Wouldn't it? You see? You know?" etc. This process is termed ' sympathetic circularity.'
9. Individual selection from a group of idiomatic phrases or sequences will frequently occur.
10. *The individual qualification is implicit in the sentence organisation: it is a language of implicit meaning.*

A *formal* language is one in which the formal possibilities and syntax are much less predictable for any one individual and the formal possibilities for sentence organisation are used to clarify meaning and make it explicit. The person, when he speaks a *public* language, operates within a mode of speech in which individual selection and permutation are grossly restricted. In the case of a *formal* language the speaker is able to make highly individual selection and permutation. Of course, a *formal* language speaker does not always do this, but the possibility always exists for him. The characteristics of a *formal* language are:

1. Accurate grammatical order and syntax regulate what is said.
2. Logical modifications and stress are mediated through a grammatically complex sentence construction, especially through the use of a range of conjunctions and subordinate clauses.
3. Frequent use of prepositions which indicate logical relationships as well as prepositions which indicate temporal and spatial contiguity.

* This does not mean that the *quantity* of speech is necessarily reduced.

4. Frequent use of the personal pronoun ' I.'
5. A discriminative selection from a range of adjectives and adverbs.
6. Individual qualification is verbally mediated through the structure and relationships within and between sentences.
7. Expressive symbolism discriminates between meanings within speech sequences rather than reinforcing dominant words or phrases, or accompanying the sequence in a diffuse, generalised manner.
8. It is a language use which points to the possibilities inherent in a complex conceptual hierarchy for the organising of experience.

These characteristics must be considered to give a *direction* to the organisation of thinking and feeling rather than to the *establishing* of complex modes of relationships. The characteristics are relative to those of a *public* language.

Each of these two sets of criteria refers to an ideal linguistic structure but what will be found empirically is an orientation to this or that form of language use. It is clear that some of these characteristics will occur in most forms of language use but a *public* language is a form of usage in which all the relevant characteristics will be found. It is possible to consider approximations to a *public* language to the extent that other characteristics are not found. Although any one example of a *public* language will be associated with a particular vocabulary and sequence frequency, it is worth while emphasising that the definition and characterisation are independent of content. Here we are concerned with the implications of a general mode, not with the isolated significance of particular words or speech sequences. This is not to suggest that middle-class children are the only ones oriented to a *formal* language but the probability is certainly much higher for this group. Neither do such children learn only a *formal* language. The mode of speech used can and does, in most cases, vary according to the type of social relationship involved. The speech behaviour of middle-class children, or for that matter children from any class, will in the peer group, approximate to a *public* language, and will tend to release behaviour regulated by the form of speech. Middle-class children will have access to both forms which will be used according to the social context. This will lead to an appropriateness of behaviour in a wide range of contexts. Other children, a goodly proportion of the total population in this and other countries, are likely to be restricted to one form, a *public* language. This will be the only form known: the only one that can be used.

Some of the implications of this restricted form of linguistic behaviour have a bearing on the educational picture described at the beginning of this discussion. Because of the simple, often broken, sentence structure and the rigid range of formal possibilities available, a *public* language will be one in which logical modification and stress can only be crudely rendered linguistically. This necessarily affects the length and type of the completed thought. Of equal importance, the verbal planning function is shortened. The shortening of this function often creates, in sustained speech sequences, a large measure of dislocation or disjunction. The thoughts are strung together somewhat like passing beads on a frame rather than following a planned sequence. The restricted verbal planning function also creates a high degree of redundancy, by which is meant a large

measure of repetition of information or sequences which add little to what has previously been given. This is vividly illustrated by the two transcripts of tape-recorded discussion which follow:

> " It's all according like these youths and that if they get into these gangs and that they most have a bit of a nark around and say it goes wrong and that and they probably knock someone off I mean think they just do it to be big getting publicity here and there."
>
> Age 16. I.Q. Verbal 104; Non-verbal 100

> " Well it should do but it don't seem to nowadays, like there's still murders going on now, any minute now or something like that they get people don't care they might get away with it then they all try it and it might leak out one might tell his mates that he's killed someone it might leak out like it might get around he gets hung for it like that."
>
> Age 17. I.Q. Verbal 99; Non-verbal 126+
>
> (*From a transcript of a tape-recorded discussion*)

As there is a limited and rigid use of individual qualifiers, the adjectives and adverbs function as *social* counters through which the individual qualification will be made. This drastically reduces the verbal elaboration of the qualification which is given meaning by expressive signals. This does not mean that the gross number of adjectives and adverbs in speech samples taken from the two linguistic forms will differ very much but that the range will in one case be restricted. The qualifiers will be drawn from a lexicon *commonly* held, and (as it were) slotted into position, rather than being individually selected for a specific purpose. In this sense the qualification tends to be *impersonal*. Ongoing research tends to indicate that adjectives and adverbs used in *formal* language speech samples from subjects matched for age and very high non-verbal I.Q. with *public* language subjects, are only rarely not present in the active or passive vocabulary of the *public* language speakers. Feeling, then, is differentiated by referents which are the result of shared conditioning.

A *public* language is a vehicle for expressing and receiving concrete, global, descriptive relationships organised within a relatively low level of conceptualisation. The words and speech sequences refer to broad classes of contents rather than to progressive differentiation within a class. The reverse of this is also possible: a range of items within a class may be specified without knowledge of the concept which summarises the class. The categories referred to tend not to be broken down systematically and this has critical implications if the reference to be designated is a subjective state of the speaker. Despite the warmth and vitality, which is an expressive correlate of the language, it tends to be *impersonal* in the literal sense of that word. The original linguistic relationship between mother and child exerts no pressure on the child to make his experience explicit in a verbally differentiated way. It is perfectly possible, despite a restricted vocabulary, to create speech which fits individuated experience, but the orientation induced by this mode of communication does not make such characterisation appropriate.

The mode of speech, itself, will elicit and reinforce a special affective or emotional correlate. The speech delivery within a normal environment, outside the classroom,

tends to be composed of fast, fluent, short, relatively unpaused utterances. Affect (expressive signals) is not used to discriminate finely among meanings carried within a speech sequence; rather it is used to reinforce dominant words or phrases, or accompanies the utterance in a diffuse manner. The feelings of the child would seem to be, relatively, undifferentiated for two reasons. Feeling is not differentiated, stabilised and made specific by linkage through language to a wide range of referents. Secondly, feeling which is regulated by the speech is conditioned by the form of the language. It is a vehicle for expressing concrete, direct, activity-dominated verbal sequences. It reinforces a relationship of immediacy with the environment. The gap between feeling and doing may well be brief. It should be unnecessary to add this, but nothing that has been said should be taken to mean that the natural feelings of sympathy, generosity, kindliness and warmth are not to be found, equally present, in all social groups.

A *public* language focuses upon the inhibiting function of speech by directing attention (the attention of the observer) towards potential referents which carry no stimulus value for the speaker. In as much as a *public* language induces in the user a sensitivity towards the concrete here and now—towards the direct, immediate, the descriptive, the global—then the dimensions of relevance will tend to preclude responses to other patterns of stimuli. Thus an orientation towards a particular type of learning under particular conditions is also involved. An example of this inhibiting function would also illustrate the significance of the seventh characteristic of the language. It was suggested that there would be frequent use of statements in which the reason and conclusion are confounded-to produce a categoric sentence.

Imagine the following two conversations on a bus. A mother has a child sitting on her lap.

Mother: Hold on tight.
Child: Why?
Mother: Hold on tight.
Child: Why?
Mother: You'll fall.
Child: Why?
Mother: I told you to hold on tight, didn't I?

Mother: Hold on tightly, darling.
Child: Why?
Mother: If you don't you will be thrown forward and you'll fall.
Child: Why?
Mother: Because if the bus suddenly stops you'll jerk forward on to the seat in front.
Child: Why?
Mother: Now darling, hold on tightly and don't make such a fuss.

In the first example a whole range of potential learning and connections have been cut out by the categoric statement. The natural curiosity of the child has been blunted. There is no causal chain between the mother's request and the child's expected response. The change in the behaviour has been brought about by a process akin to verbal condi-

tioning rather than through instrumental learning. If the child challenges the statement then in a short period he is challenging the *right* of the mother to issue the request, that is, he is challenging the authority which inheres in the status of the mother. The potential social power in the form of the relation is revealed very quickly.

In the second example the child is exposed to an area of connection and sequence. If this is challenged then another set of reasons are elicited. Of course, after a time the categoric statement is applied but an order of learning has been made available in between. It should be noted that as the result of the linguistically elaborated relationship the initial challenges are of the reasons given to support the request. The challenge of the mother comes much *later* in the relationship and the latent social power is revealed later *and* under different conditions. If the categoric statement is used frequently in a *public* language then it limits learning and curiosity and induces a sensitivity towards a particular type of authority in which social power is quickly and nakedly revealed. The categoric statement becomes part of a language which narrows the range of stimuli to which the child responds. The length of this example also indicates how difficult it is to give concrete illustrations in a short paper.

An important psychological correlate of a *public* language is that it tends to discourage the experience of guilt. However, strong feelings of loyalty and responsibility to and for the local group will exist. Earlier it was suggested that the verbalising of subjective states, particularly of motivation, is not highly relevant. This implies that the referents of these states are not selectively reinforced by language. Koln has drawn attention to the fact that middle-class parents are more likely to respond in terms of the child's *intent* in acting as he does, whilst working-class parents are more likely to respond in terms of the *immediate* consequence. Thus the working-class parent is responsive to ends directed to inhibiting disobedient or disreputable acts, while the middle-class parent is responsive to intent and acts with reference to individualised standards. Simply, there is little *talking through* of acts which require disciplinary measures in working-class homes, little verbal investigation of motive.

The rational control and manipulation of induced guilt is a major means available to the middle-class mother for disciplining the child. These means reinforce the individualising process in the child and transfer attention from consequence, or result, to *intent;* from the act to the *processes* underlying the act. This is not the case for a child whose mother speaks a *public* language. In this case behaviour is more likely to be made subordinate to shame. Shame indicates a diminution of *respect* accorded to conduct by a group. It is psychologically different from guilt. Of course, the middle-class child is sensitive to feelings of shame; the point is that he is also sensitive to guilt.

A *public* language user will be aware that an act is wrong or that punishment is just, but feelings of guilt will tend to be divorced from the notion of wrongness. This would seem to make more likely the re-occurrence of the behaviour and to create a particular attitude to the punishment. It is not for one moment suggested that because motivational processes are verbally available to an individual, that these, in themselves, will always inhibit an action; only that the action would be accompanied by psychological states which might not be present if a child spoke a *public* language. There is a tendency for this to be recognised. Punishment of a *public* language user in a school will frequently

tend to be corporal, threatened or actual, because it is difficult to elicit a sense of guilt or a sense of personal involvement in the act. Though caning, etc., does exist in Public schools where a *formal* language is spoken, other methods are *also* used to modify behaviour. With a *formal* language user, punishment can involve a temporary rejection, or a talking through of the misdemeanour aimed at increasing the experience of guilt, responsibility and so of personal involvement. Attempts to interchange the means of social control may lead at first to many difficulties. This is *not* to be taken to mean that corporal punishment is necessarily an effective means of social control. Where it is used as a substitute for the real difficulty of making a social relationship, it is rarely effective.

This rather difficult argument has tried to make clear how learning may be conditioned where the only language of the child is *public*. In the learning of this linguistic form, the child is progressively oriented to a relatively low level of conceptualisation. It induces a lack of interest in processes, a preference to be aroused by, and to respond to, that which is immediately given, rather than responding to the implications of a matrix of relationships. Such an orientation partly conditions the intensity and extent of curiosity, as well as the mode of establishing relationships. In turn, this will affect what is learned and how it is learned and so influence future learning. There will be a tendency to accept and respond to an authority which inheres in the form of the social relationship rather than in reasoned principles. It fosters a form of social relationship which maximises identifications with the aims and principles of a local group rather than with the complex differentiated aims of the wider society. Finally and of the greatest importance, it is a language of implicit meaning in which it becomes progressively more difficult to make explicit, and to elaborate verbally, subjective intent.

This behaviour is all of one piece and is maintained as a relatively 'steady state' by protective devices built into the language system. Perhaps the most important of these protective devices is that a *formal* language (as used, for example, by the teachers) will be mediated through the *public* language. In the process of mediation, any alternative orientation which would sensitise the listener to a different dimension of significance is neutralised. Where a translation cannot be made there is no communication. It tends to inhibit the verbal expression—and hence the learning attendent on such expression—of those experiences of separateness and difference which would isolate the speaker from his group. It channels cognitive and affective states which, if expressed, might constitute a potential threat to the equilibrium. For example, curiosity is limited and focused by the relatively low level of conceptualisation. The restricted planning function and the concern with the immediate, tend to make difficult the development of a reflective experience. There is a tendency, too, to shift responsibility from self to the environment and this further reinforces the rigidity of the behaviour.

Conclusion

It can be seen that attempts to change the system of spoken language of children from certain environments will meet with great resistance, passive and active. It is an attempt to change a pattern of learning, a system of orientation, which language originally elicited and progressively reinforced. To ask the pupil to use language differently, to qualify verbally his individual experience, to expand his vocabulary, to increase the

length of his verbal planning function, to generalise, to be sensitive to the implications of number, to order a verbally presented arithmetic problem, these requests when made to a *public* language user are very different from when they are made to a *formal* language user. For the latter it is a situation of linguistic development whilst for the former it is one of *linguistic change*. Two different psychological states underlie these situations. The *public* language speaker is called upon to make responses to which he is neither oriented nor sensitised. His natural responses are unacceptable. It is a bewildering, perplexing, isolated, and utterly defenceless position which ensures almost certain failure unless the teacher is very sensitive to the child's fundamental predicament.

This is by no means to say that a *public* language speaking pupil cannot learn. He can, but it tends to be mechanical learning and once the stimuli cease to be regularly reinforced there is a high probability of the pupil forgetting. In a sense, it is as if the learning never really gets inside to become integrated into pre-existing schemata. In fact, it looks as if this is so, for unlike the *formal* language oriented pupil, the *public* language pupil lacks these receptive schemata or if he possesses them they are weakly organised and are unstable.

The very conditions of the classroom situation often make effective education impossible. Large classes reduce the possibility of individual teaching, increase the probability of impersonal authoritarian methods of class control, which in turn increase the passivity of the pupil. If the teacher avoids this by small group techniques then, inevitably, he adds to his fatigue and in the long run may reduce his efficiency. There is a case for a general rule—the lower the status of the pupil, the smaller should be the number in the class. Expensive as this may seem at first sight, it might be economical in the long run. A small class is the basic condition for a close psychological relationship (inter-personal rather than inter-group) between teacher and pupil. The social organisation must enable the person, as well as the function, of the teacher to be felt and perceived. In an important sense, the teacher of a class of *public* language speakers is much more exposed, psychologically, if he is to teach efficiently. He cannot retreat into his formal role and impersonalise his communication. This does not mean that the appropriate teaching situation is one of all ' pals ' together. Nor does it require teachers who can ' speak the language.' In this respect there are only two types of teachers: those who can and those who cannot.

This is not the time to discuss techniques but perhaps it might be possible to seek agreement about the nature and ramifications of the educational problem. Although it appears very similar, the backwardness presented by the *public* language pupil is different in its dynamic form from that of the pupil whose backwardness is the result of psychological factors. It is a culturally induced backwardness transmitted and sustained through the effects of linguistic processing. The relationship, it is suggested, between potential and developed intelligence is mediated through a language system which encourages insensitivity to the *means* whereby the pupil's dimensions of relevance may be expanded and enhanced. It follows also that the condition progressively worsens over the years. As the educational process becomes more analytic and relatively abstract at the secondary level the discrepancy between what the pupil can do and what he is called upon to do is painfully revealed.

A *public* language speaker has at his disposal a vast range of potential responses. His behaviour is by no means standardised. The general cognitive impoverishment is an impoverishment only from the point of view of the educator and, of course, it deprives society of potential talent. However, it is a form of language which symbolises a tradition where the individual is treated as an end in himself, not as a means to a further end. It psychologically unites the speaker to his kin and, on a sociological level, to his group. It should not be under-valued. Under the most hopeful circumstances the educational process increases the risk of the speaker's alienation from his origins. The task would seem to be to preserve for the speaker the aesthetic and dignity which inheres in the language, its powerful forthrightness and vitality but to make available the possibilities inherent in a *formal* language. We must be very sure that the new dimensions of relevance made available do not also include the measuring of human worth on a scale of purely occupational achievement.

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DULL AND BACKWARD CHILDREN: POST-WAR THEORY AND PRACTICE

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> "Human nature could be changed," said Dr. Wall.*
> "Intelligence could be changed. Environment could be changed and organised to create intelligence and personality. Change was the purpose of education."

* *Dr. W. D. Wall, Director, National Foundation for Educational Research in England and Wales. Reported in the 'Times Educational Supplement,'* 8/7/60.

Introduction

THERE are at present two distinct schools of thought about the nature of intellectual dullness, and the consequences which flow from each are markedly different. For the first, dullness is largely or entirely innate; it can be diagnosed with some confidence and the diagnosis is a prognosis. The child's optimum possible functioning and rate of progress can be gauged more or less from his I.Q. The ultimate goal of the teacher is that of helping the dull child to 'work to capacity', i.e., to bring his attainments up to the level of his mental age. Beyond this we cannot greatly go.

For those who hold a different view, the result of an intelligence test gives a measure of present 'operational ability,' a compound of the result in general attainment of the interaction of education (formal and informal) and the child's native ability to learn. Though there are probably limits to what he can do, the teacher's task is to increase his pupil's all-round 'operational intelligence' by improving not merely formal attainments but those mental skills which we recognise as general ability or intelligence.

Both schools of thought have authoritative and respected proponents. For the teacher, a study of the respective viewpoints is more than an academic exercise.

The Pre-War Situation

Our State education system, though still young, suffered from stern foster-parents in its earliest years. Less than a century has elapsed since a system known as 'payment by results' was introduced for teachers in elementary schools. It was, of course, abandoned in practice, and Sir Cyril Burt proved that it had no theoretical basis. To him we owe the first systematic surveys of the nature and extent of backwardness in schools in this country—surveys which date back to 1913. From him we gained an analysis of 'the backward,' revealing the individual needs and characteristics of children who were backward and suggesting forms of organisation and treatment within the school system.

Our educational system was not alone in its problems, or in its proposed adaptations to meet them. Terman, in his *Measurement of Intelligence* (1919), pointed out that " between a third and half of school-children " in the U.S.A. were failing to progress through the grades at the expected rate; " from 10 to 15 per cent. are retarded two or more years " and " from 5 to 8 per cent. are retarded at least three years."

The scientific basis for a new approach had its roots in the work of Galton, the ' father of mental tests,' and of J. M. Cattell who coined the name ' mental tests ' in 1896. Binet, in France, devised a practical ladder of ability against which children could be measured, a ladder which was adapted by several countries to suit their requirements.

Hadow re-organisation here encouraged the formation of ' C ' streams and highlighted the problem of backwardness. Notwithstanding the over-sized classes, the 'thirties saw some notable efforts to make provision for some of the school failures. One of the better-known of these pioneering attempts to meet the situation was described by M. E. Highfield (then M. E. Hill) in *The Education of Backward Children*. Her Local Education Authority sought both to survey the nature and extent of the problem and to cater for the backward as units within the educational system. One of the conclusions reached was that, " 10 to 15 per cent. of the children in a re-organised school would be so retarded as to prevent them benefitting appreciably when educated in a ' C ' stream class." (p. 12).

Within the re-organised schools then, something more than a ' C ' stream was considered necessary for up to 15 per cent. of the school population in that authority. This confronted the L.E.A. with tasks beyond its immediate capacity.

Those responsible for educational provision felt, as the Director for Education expressed it, " like craftsmen attempting to work in a medium the composition of which they did not fully comprehend." More significant still, they were acutely aware of an emergency situation. " More than 50 per cent. of juvenile delinquents were school misfits: inside the school there was a distaste among the teaching staff for work with ' C ' stream classes."

In circumstances such as this, the theories and humane considerations put forward by Burt offered more than a chart and a charter; they went beyond what even the most progressive authorities were able or prepared to follow.

The specialists called in to suggest remedies were having to face an emergency situation. In this context it is understandable that one recommendation was, " that the individual scheme in reading and number shall form the basis for schemes of work for *small tutorial classes* accommodating no more than thirty children." Today it would be agreed that such schemes are likely to be ineffective in classes of more than 20 children.

Such was the size of classes in general and so haphazard and uneven the form of provision that the experiment at Southend-on-Sea stood out for teachers like the lights of Blackpool to their pupils. At this period, too, the theory implicit in much mental deficiency practice was that the mentally subnormal were in some way a different species, were ' sick,' ' peculiar,' and a matter for doctors rather than teachers. This attitude prevailed not only towards children who had suffered evident organic damage and were

in need of medical attention or constant supervision, but towards all children in Occupation Centres and Special Schools who were considered respectively ' trainable ' and ' educable.' It was rare to find explicit or implicit the concept that everything (apart from specifically physical medical treatment) which aims at improving a child's status as a functioning human being is, in fact, educational. The label ' mental defect ' was not merely incorrect but became a stigma. What is worse is that it tended to overflow to mark the category known as ' the dull and backward.'

By 1937, at least 51 Local Education Authorities had introduced special classes in some form, occasionally restricted to 20 pupils in the class. It is difficult to be sure precisely of the intellectual status of the children in these classes. These initiatives, however, convinced a Committee of Inspectors in 1937 that " where small special classes appropriately staffed " had been tried, it could be stated " with conviction that the chief gain to the children had been an improvement in outlook, a moral and social gain."

In general theory and by and large in practice, Burt's definition of the dull and backward child had been generally accepted. A dull child was one whose intelligence quotient fell below 85; and the feeble minded or mentally defective were those below 70. In practice, however, no special move appears to have been made to select dull, and therefore backward, children for special or separate treatment and experiment. It was assumed that the ' feeble-minded ' (I.Q.s 50-70) were in Special (M.D.) Schools, and Special Classes, where they existed, were assumed to have children who ranged upward in I.Q. from 70. However, the Board of Education, in 1937, drew attention to the fact that the normal school pattern was often complicated by the presence in ordinary classes of ' certifiable ' children.

In most areas the *dull and backward* as defined by Burt, were to be found in classes which included all the degrees and kinds of backwardness then recognised, ranging from the child of normal general ability who was behind in school work (i.e., had an educational quotient below 85) to the ' feeble-minded '—and included pupils whose principal problems were behavioural or emotional.

To this confused situation must be added the complicating factor that few teachers of the backward were trained in techniques of infant or remedial education, in psychological and educational diagnosis, or could successfully adapt what they did know to the social, emotional, physical or intellectual levels and needs of the different age groups. In such circumstances the general pattern of practice could hardly be considered to have shown what could be done with and for such children. Nor, indeed, had existing theory been utilised in practice to the limits of its usefulness.

The Dull and Backward—a shifting Concept

The 1944 Education Act provided new opportunities from the points of view of provision and practice. It was accompanied by a shift in theory, a shift of emphasis if not of substance. In practice a more subtle and flexible approach became possible and the changing concepts led many teachers and research workers to develop and change their practices if not the actual statement of their theories.

The recognition that equality of opportunity really implied further differentiation of provision, gave rise to definitions of ten categories of handicapped children who needed special arrangements for their education. It became the duty of each L.E.A. to ascertain precisely how many pupils came within each of these ten categories and to make special educational provision accordingly. The largest of these categories was virtually a new one: *the Educationally Subnormal.*

A child was considered to be educationally subnormal if his *attainments* did not exceed 80 per cent. of the attainments of an average child his age. This applied irrespective of the assumed causes of such backwardness and whether or not it was considered remediable. The Educational Quotient had come into a new prominence and the school system was pledged to tackle this substantial area of backwardness as a special problem.

This definition did not extend to children excluded from the school system as *ineducable* (and therefore the responsibility of the Health Authority); and it was thought to include some 10 per cent. of the entire school population.

In 1946 the Ministry estimated that about 12% of these ESN pupils in urban areas would require special ESN schools. The size of this fraction suggests that the concept guiding the Ministry had much in common with the pre-war concept of 'feeble-minded.' "Past experience suggests that children cannot be educated at school when their intelligence quotient is below about 55." Similarly, "a child with an intelligence quotient of more than 75 should rarely find his way there" (i.e., to the Special School) "as his recuperative powers are so much greater than those of the majority of pupils in special schools."

In urban areas, then, the *dull and backward* would be incorporated in a broad band of ESN children whose I.Q.s exceeded about 70 and who were, therefore, not considered to need special placement, except in rare cases. However, unless the pupil was at least 20% behind average in his attainment, he was not ESN. If we compare this with the I.Q. range 70-85 for dull and backward it can be seen that, theoretically at least, a substantial minority of those formerly thought dull and backward and in need of special programmes were to be omitted from the new category ESN. Such children (i.e. those with I.Q.s above 80 and E.Q.s to match) are today absorbed within normal school provision. The L.E.A., however, was now duty-bound to make special educational treatment available for all ESN children (other than the 'feeble-minded') within the ordinary school or in additional special schools.

Practical and Theoretical Consequences of Provision

The new situation should be seen in perspective, with the substantial changes in physical provision viewed against the background of the need. The population of special ESN schools trebled between 1946 and the beginning of 1960 (from 11,000 to 33,000 pupils). A serious effort was made to train teachers for the task. At the University of Birmingham the Diploma in Child Psychology begun by Valentine before the war was revived in 1945. This provided a general training in applied educational psychology with emphasis, in the training and research programmes, on educational failure with

otherwise normal ability. The course was not specifically for teachers in special ESN schools or for those working with 'dull' children, although it provided a thorough training in educational diagnosis and remedial work. In 1950 the first course specifically intended for teachers of handicapped (ESN) pupils was begun at the Institute of Education, London. This one-year, full-time advanced course for experienced teachers was followed in 1954 by a similar course in Birmingham. By 1960 there were a further eleven courses of a year's duration considered suitable for teachers of ESN children, but altogether they barely provide sufficient teachers to replace the expected annual loss from special schools alone. This growing but proportionally small band of specialised teachers is doing much to leaven the increasing number of teachers without special training entering our trebled special schools.

The situation in the schools themselves is not static. In 1956 the Ministry, following upon changing estimates of the need, urged Local Education Authorities to make a more comprehensive survey. As a result, the Ministry concluded that 52,000 places in special schools were required today, i.e., 0·8% of the school population and 19,000 more places than yet exist.

If we accept these figures, it seems that two-thirds of the children thought to need special school placement are now placed. It is, however, questionable whether these figures do reveal the full extent of the need for the kind of treatment provided in special schools. A number of variables are clearly involved and include the nature and flexibility of the school system in each local authority. The less flexible the system the more special provision is necessary outside the normal run for those who cannot adapt. Other variables immediately suggest themselves.

The Ministry's estimate of the current need might more effectively react upon theory if we could be sure that it is comprehensive—if only in urban areas. Comparison then with the Wood report (1929), for example, might be fruitful. Dr. E. O. Lewis found that 1·8% of the school population in urban areas had I.Q.s between 50 and 70. Had this proportion decreased by 1956—and if not, what is happening to those children not in special ESN schools? Is the I.Q. proving a less important factor in assessing whether special school provision is necessary for a given child, and if so what other factors are being taken into account? What new forms of diagnosis and prognosis have evolved *in practice*? How, in fact, do children within the 50-70 I.Q. band who remain in normal schools compare with children thought suitable for special schools?

At the time of the Lewis report there were 33,000 children who had been ascertained for special schools and the Board of Education was convinced that this ascertainment was "far from complete." Sir Cyril Burt and the Scottish Council for Educational Research found that about 1·5 per cent. of the urban school population come within the band requiring the kind of treatment expected in special ESN schools.

The most recent estimates of the need for special ESN school places are, therefore, perplexing, and all the more so when one discovers that something like a third of the special ESN school population falls outside the 50-70 I.Q. band and ranges from a few with I.Q.s below 50 to a substantial group with I.Q.s above 70.

It would be gratifying to think that there had been a shrinkage in the proportion of children within the 50-70 I.Q. band. It would be equally encouraging to believe that

the ordinary school was more and more proving capable of absorbing and educating a growing proportion of these children. Experience in both special and ordinary schools however, discourages us from drawing such conclusions from any such comparisons with pre-war estimates. Special schools vary from locality to locality (and even within the one locality) in the range of children they accept. The obstacles to making an objective estimate of the need today are numerous, if often obscure. A case in point is indicated by recent research carried out by the Department of Social and Preventive Medicine, University of Manchester, into such an element as ' social selection ' at each stage of the ascertaining process, from (*a*) the rate of referral from schools of different kinds; and (*b*) the subsequent decisions by the School Medical Officer; to (*c*) children subsequently admitted to institutions. Susser found, from a follow-up study of educationally subnormal children, that it was possible to show that the cultural characteristics of a family " were very significant in determining whether or not they would be selected as part of a sample of ascertained educationally subnormal." It is equally evident that parental opposition, though undoubtedly diminishing, still varies from area to area and plays a role in discouraging special school placement.

How far Local Authorities have tried to meet this opposition by devising other forms of special provision rather than sacrificing the child is not known. An interesting experiment which might merit closer study in this respect, is that in Great Yarmouth, where special classes within the ordinary school have been organised—such classes being limited to between 8 and 15 pupils who have been ascertained as ESN.

In today's situation, then, we are left to conjecture how far normal schools are still having to cope with children within the 50-70 I.Q. range, and how far such children prove *able to hold their own and progress* within the normal school; how far is low measured general ability relevant by itself and how far other factors determine success.

If for convenience we distinguish the special school group much in the old way from the dull and backward, who might well be educated in the ordinary school, then there are a number of further questions to be asked. We need to know, for example, how children who are *dull and backward* but form a sizeable proportion of the population of many special schools, respond to such placement and treatment; and how the results of such provision compare with the progress made by a matched group of dull and backward children in the ordinary school.

There is certainly a case for comparing matched groups of dull and backward children at both the primary and the secondary stage in good special schools and good remedial departments (or classes) in ordinary schools.

We have little objective information to guide us here. One recent research by Stein suggests that " special school education has made a significant contribution to literacy in children with intelligence quotients under 70; those with intelligence quotients over 70 had usually attained literacy whether or no they had special education. In arithmetic, children with I.Q.s over 65 who are yet within the educationally subnormal range are helped to attain numeracy by special education which they may not attain if they do not have such education."

Specific research with the dull and backward is difficult to find. One investigation which is mentioned elsewhere in this article has some relevance here. " In an extensive

case-study search for 'just dull' children" Stott found, as well as a low level of ability "at least one feasible reason . . . for the backwardness" and concluded that "it is doubtful if such 'just dull' children exist."

There is thus doubt as to both the extent and the nature of the problem of 'dullness' as well as to the kind of provision required and the possible changes which might be effected by 'special educational treatment.' Even if we reduce the upper limit of the dull from an I.Q. of 85 to one of 80 (to match the upper E.Q. proposed by the Ministry for the ESN), we would still have to recognise that practice, as before the war, is influenced as much by provision as by theory. The area of doubt can be expected to remain until a substantial number of primary and secondary schools (of 'modern' type) have at least one suitably qualified teacher of ESN children, a need recognised in the 1954 Report of the Advisory Committee on the Supply and Training of Teachers of Handicapped Pupils. At the present rate of teacher-training, the minimum number, suggested by the Advisory Committee, of 10,000 teachers required would take more than half a century to provide.

Shifts from the Theories Guiding Pamphlet No. 5

The proposals in the Ministry's pamphlet on Special Education (1946) were made within certain theoretical concepts. 'Intelligence' is regarded as fixed and probably innate. "It is a matter of general agreement that intelligence cannot be substantially improved by any methods known to us at present, and that aptitudes verbal or practical are not readily alterable except, perhaps, by skilled teaching over a long period. Retardation due to limited ability is not likely to be quickly or easily overcome even by the best forms of special educational treatment, and where the limitation is in general intelligence, the retardation is unfortunately likely to be permanent."

The concept of 'mental age' proved invaluable, in suggesting an organisational framework, stressing individual differences among children of the same chronological age, providing a starting point for treatment and indicating the apparent rate of maturation and school progress to be expected.

With *literacy* having been defined as reading age of 9 plus, it tended to be accepted that a dull and backward child with an I.Q. of no more than 70 might under favourable circumstances attain literacy before his thirteenth birthday—assuming that no specific handicap prevented this. Even a child of much lower ability (e.g., an I.Q. of 60) might achieve literacy by the age of 15 (a year before statutory leaving age in special schools). This theory discouraged helplessness or 'baby-minding' on the part of the education system and encouraged experiment.

At first, research seemed to emphasise the constancy of the I.Q. and the tendency for it to decline earlier amongst dull children. Wider application of tests and new generally acceptable evidence modified such theories. By 1951 the shifting view-point is evident in such cautious departures from pre-war axioms as were evidenced in the revised version of M. E. Highfield's book. She now states that, "In the early days of group intelligence testing, there was a tendency to accept the results uncritically as predictive of the child's capacity to learn. However, it became apparent as discrepancies multiplied that the I.Q. could prophesy falsely."

There was no longer the statement, formerly in italics, which had guided many teachers, " a measure of the child's intelligence or innate capacity to learn should set the ideal standard of attainment for that child." There was nevertheless reference to " considerable statistical evidence " which showed that " for the vast majority of children the I.Q. fluctuated very little and that it is a reliable predictive measure, at least over a period of two or three years."

Few today would challenge this conclusion although its relevance could now be debated. As the I.Q.s had been estimated from different age groups whose environments alter little in " two or three years " there could be little reason to expect significant rises in I.Q. for the majority of the school population over a short period. Such a conclusion might be of value to the administrator but offered no illumination for special educational treatment. Far more important is a study of why the minority change and change markedly. Vernon suggests that some of our pessimism about the modifiability of the I.Q. may be due to the nature of the measures used—" our current intelligence tests make no attempt to measure modifiability or learning capacity as such." He also emphasises that ' intelligence ' operates in a context of personality, and especially in a framework of motivation and learned behaviour—" it seems curious that many people whom we would regard as intelligent, and who do quite well on our tests, are in fact not very well adapted to the physical and social environment in which they live."

We have some evidence which cannot be ignored that the *constancy* of the I.Q.—even allowing for a margin of error in testing and fluctuation in the functions measured—breaks down when individual intelligence tests are given to children in Special ESN Schools. Frances Lloyd for example, not only records some dramatic changes in I. Q. in her school (changes which she attributes to wrong diagnosis or to a failure to detect emotional difficulties—as with one child who leapt from being within the ' ineducable ' range, I.Q. 45, to beyond the range for special schools, I.Q. 89) but shows, in figures quoted by Child, that 24% of her pupils had made a steady and significant gain in I.Q., 19% a steady fall, and 50% showed an irregular pattern of I.Q. development.

In a recent study by the writer, where the I.Q.s of 72 Secondary ESN Boys had been recorded over a period ranging from two to nine years of schooling, 75% fluctuated more than 5 points, 41% more than 10 points, 20% more than 15 points and $5\frac{1}{2}$% more than 20 points. This, it should be emphasised, was on individual tests by trained testers. Sadler, another headmaster of an ESN school, revealed equally substantial changes in an unpublished thesis. His pupils altered in I.Q. within a range of minus 13 points to plus 26. In a subsequent analysis of the situation in his school, Sadler found that where the pupil's condition was complicated by remediable factors affecting sight or hearing, or by social and emotional factors, the greatest changes could be affected in I.Q. if the child on entry had an I.Q. of 70 plus. With this group he records an *average* increase of 8 points. No similar rise was found where the pupil appeared to have an uncomplicated background, i.e., had a good home, was in good physical or sensory condition and did not appear to be emotionally disturbed.

In practice, such shifts in I.Q. on the tests used in Ascertainment procedures, could re-classify a significantly large group of children according to the importance attached to the I.Q. and the year in which the I.Q. was measured. Such fluctuations in I.Q.

challenge inflexible administrative procedures, irrespective of whether or not *intelligence* is considered to be improvable. Whilst it may not harm a child to be wrongly classified as suitable for a special school (and may do him a considerable amount of good) moral as well as educational issues become involved if we exclude a child from schooling partly or mainly on the basis of his I.Q. Such considerations have led the Ministry to suggest that before a decision is made a satisfactory trial period for those bordering on the 'ineducable' should be given in special schools or in units where special educational provision is made. Equally it should be urged that a satisfactory trial should be given to children whose dullness is such that transfer to special school provision *may* prove necessary, in ordinary schools where special provision is made for dull and backward pupils.

It is now generally recognised that although apparently rigid classifications may be necessary for administrative reasons, they do not square necessarily with educational potential or with theory. Similarly, we know that the same numerical I.Q. in two children of the same chronological age may obscure a very wide range of individual differences and educational possibilities. Awareness of this *in practice* has resulted in more experiment and greater variations in provision than are sometimes realised. A recent survey by the Guild of Teachers of Backward Children revealed a significant *interchange* of pupils between Training Centres and Special Schools on the one hand and between the latter and ordinary schools on the other. The special school population not only shades into the dull and backward within the ordinary school, but overlaps more broadly than is generally realised. In part, this overlapping may be responsible for the pressure by some parents to have the statutory leaving age in the special school reduced to that of the normal school. Where the pupil's intellectual equals 'down the road' are leaving school at 15 and earning money, it is difficult to convince some parents that the school is other than a further restrictive influence imposed upon them by a hostile society. This may in part explain the regular practice in some special schools of *de-ascertaining* selected children at the age of 15 and enabling them to leave to go to work. Against this, it must also be noted that some parents of less able children are prepared to let them remain at school beyond 16, and it is worth recalling that the special school is permitted to retain such pupils until the age of 19.

Those concerned with the ESN would agree that there is a need for a regular review of each case of dullness, a review which already takes place in special schools but cannot always be matched by appropriate placement or transfer of the child. Change to an ordinary school, for example, poses the question, "*which* ordinary school is able to help *this* pupil?" Change *within* an ordinary, streamed school may be obstructed by the size of classes and the need to *demote* a pupil to balance any promotion. A non-streamed school may have advantages here which must be contrasted with the disadvantages inherent in a situation which, because of class size, may make *special* provision impossible. 'Placement' of a child involves a plurality of factors requiring consideration quite apart from I.Q. or mental age.

Selection of the dull and backward

It is interesting to note that a variety of forms of practice have evolved in different countries from similar theoretical bases. The countries which met for the annual con-

ference of the International Bureau of Education at Geneva in 1960 put forward classifications of ' educable mental defectives ' which would in some cases incorporate those we have defined as dull and backward. One group of countries (our own, along with some Commonwealth countries, China, France, Sweden, Israel, Japan and Thailand) provides special schools for children within the 45/50-75 I.Q. range. The lower I.Q. floors in some countries indicate how arbitrary the lines of demarcation are. A second group distinguishes between the 50-70 I.Q. range who go to special schools and the 70-80 I.Q. range who attend Special Classes (Norway and the Phillipines). A third group widens the band of special school children to the 50-80 range (Australia, Argentina and El Salvador) or even the 45-90 range (some cantons of Switzerland). A fourth group considers the 45-60 I.Q. range equivalent to the imbecile category (Netherlands) or merely caters in special schools for children with I.Q.s of 65-85 (German Federal Republic). There is a fifth group which falls outside the above in not using intelligence tests at all (U.S.S.R., Hungary, Ukraine, Byelorussia, Rumania) or in using them only as ' an auxiliary criterion ' (Czechoslovakia).

There is however, as the countries of the I.B.E. report note, a marked shift away from the use of the I.Q. as a sole or even the predominant element in the decision to place a child in a special school or class. The conference did however tacitly retain the word 'mental *defect*' with its implication of aberration or even an organic basis for mental subnormality—and this in face of the proposals of an expert international group called together by W.H.O. and Unesco in 1954. The report of this group stresses both the possible modifiability of the level of intellectual functioning and the demonstrable fact that most mentally or educationally subnormal children are in no sense *defective*.

Practice as reflected by the I.B.E. report, then, lags somewhat behind even the theoretical position of a decade or so ago. It has hardly begun to consider such evidence as that put forward by Stott in his James Wykeham experiment. He suggests that there is no quick and easy way of sorting out those children who require long-term, all-round treatment from those likely to respond quickly to suitable remedial measures. In his experience, only the child's actual progress within the remedial setting and under skilled guidance can decide this. Doubts regarding the predictive value of the I.Q. have led such psychologists as Kellmer Pringle to criticise the training of teachers in intelligence testing as such and to urge that tests should be used for the qualities of mind they reveal, i.e., diagnostically rather than prognostically. Such diagnosis coupled with practical suggestions to the teacher might well result in a new break-through in educational diagnosis and techniques. It might well, too, lead to a generalising of improvement in I.Q. reflecting a general improvement in intellectual functioning.

It is interesting to note that Binet's work is increasingly quoted today from a new angle—from the emphasis he placed on the educability of the I.Q. and the programme he evolved called ' mental orthopaedics.' It is significant that the U.S.A. has now produced a differential diagnostic test which seeks to reveal specific weaknesses in the communication process. The Illinois Tests of Language Ability for children aged two to nine years, attempt to diagnose defects or deficits in the three processes, ' decoding,' ' encoding ' and ' association '; within two channels, auditory and visual on the receptive

side and vocal and motor on the expressive side; and at two levels of organisation, the 'representational' and the 'automatic-sequential.' The next stage of this programme is to devise remedial programmes for each of these defects or deficits.

It seems that the move is away from the somewhat pessimistic view that measured intelligence represents a limited potential towards a more optimistic view that carefully devised education based on close analytic study of the present level of a child's ability may well do something to remedy his handicaps.

Limitations of Current Theory

Criticisms of provision do not necessarily carry with them criticism of the theory implicit in that provision. Nevertheless, the strongest criticism of current practice is directed at a consequence of current theory, its weakness in relationship to the pre-school child and the infant. M. E. Highfield, for example, in her chapter on the Infant School Special Class, was guided by specific interpretations of the concept of 'mental age' and 'maturation.' She wrote, "It is clear why a dull child should be retarded—simply because his thought processes are at too immature a stage of development to enable him to assimilate the material of formal training in number and reading . . . In extreme cases he may be a defective whose mental age when he enters school at 5 years of age will be 3 years. No more can be expected of him than is demanded from a child in the younger section of a nursery school. It is a waste of time and injurious to the child to attempt a formal training in such cases."

This view would have been generally acceptable before the war. Today it is increasingly criticised as encouraging 'waiting' for suitable maturation. In some countries this concept has resulted in children being excluded from nurseries and infant schools to await maturation. "This practice," says Kirk, "assumes that kindergartens do not aid the mental and social maturation . . . and that the cultural influences of the home are not important factors in mental development."

In this respect current theory requires the closest examination. Many experts in the field would agree on the lasting and possibly determinate importance of educational influences brought to bear on the child under the age of seven.

Research outside the educational system may provide our greatest stimulus here. Not only has there been a break-through in chromosome investigations and in bio-chemical genetics but also in educational psychology and training programmes. Mundy was able to prepare a number of children for acceptance in a Special School, whereas, without her programme, they might still have been considered 'ineducable.' A hypothesis by Hebb, that transfer of training would be inversely correlated with age, was tested. This prediction was strongly confirmed by Clarke and Blackmore who state "that early training enables the institutionalised imbecile to achieve levels more characteristic of older imbecile children or adults, and to show greater relative profit from experience." Clarke found that "traditional clinical opinion which has emphasised what the imbecile cannot do, is correct only in so far as short-term observation, or very short periods of training are concerned. Limitations on learning, though considerable, are by no means as profound as had hitherto been supposed." Slomson found that "the possibility of the

successful teaching of reading and allied skills to children who produce I.Q.s of 45-55 on standardised tests, depends to a large extent on stable emotional behaviour."

The new trend within the ' ineducable ' sector of the population is creating changes in the form as well as the content of training. As Hilliard puts it challengingly in a post-war textbook on Mental Deficiency, " mental deficiency practice is tied to outdated procedures whose aim is to segregate the defective from the community rather than integrate him with it." The new direction is evidenced in such work as that of O'Connor and Tizard who demonstrated that with suitable motivation and training, it was possible " in a period of full employment " both to employ imbeciles and to make such employment of economic as well as therapeutic value.

The influence of unusual environments upon the I.Q. had already been demonstrated (e.g., negroes in the north of the U.S.A. compared with whites in the south). The demonstrated influence which a change in environment (e.g., placement in foster homes), adverse experiences and schooling have upon tested ability has modified rigid concepts of the I.Q. Similarly the Scottish surveys and Cattell's two surveys (1950 and 1957) of Leicester children confirm what is now common experience in the 11+ examinations—there is a small but significant rise in mean I.Q. on the same test given to otherwise similar groups of children separated by a generation or so. In considering this last piece of evidence we must of course bear in mind the suggestion that ' test wiseness ' accounts for some of the improvement, but this cannot be the whole explanation now that the school population has for some years been exposed to tests. It is reasonable to conclude that the change in general environment of the schools and of the homes is having an effect.

Kirk, summarising a study of the effects of early educational procedures on the child, found that children from under-privileged homes tended to stay at the same rate of development or drop in rate as they grew older but that this was reversed if pre-school education was given—the majority increasing their rate. When given pre-school education, all increased in rate of development. With institutionalised children, those who had had pre-school education tended to increase in rate of development whilst those remaining in the wards tended to drop in rate of development as they grew older. He concluded that the rate of mental development, particularly with non-organic mental defectives, was partially dependent upon early environment including school experience. It suggested a strong socio-cultural element in growth in addition to a purely genetic one.

Stein suggests that the nature of the family background of values is of similar importance. He differentiates among the educationally subnormal according to whether they come from ' aspirant ' or ' demotic ' families. In the first group some organic lesion can be expected whilst in the second group there will be cultural deprivation rather than (or in addition to) organic lesion. He found that the organic cases showed little change other than a possible deterioration as they matured, whilst the culturally deprived children could be significantly improved. Stott doubted if " ' just dull ' children exist." He considered that, "The subcultural group which Lewis (1933) postulated, meaning those individuals whose mental ability does not come up to the level needed for managing within a particular culture, really amounts to an aetiological dustbin into which all those are put for whom no organic or ' pathological ' reason for their mental disability can be found . . . "

Nor is progress limited to non-organic causes. Gellner, for example, posing a neurophysiological concept of mental retardation, devised differential tests for four major kinds of mental handicap and outlined educational programmes for each.

Here then is a substantial challenge to former interpretations of ' maturation,' and it opens new possibilities for the educator.

For the teacher, the concept of maturation requires to be at least matched by the concept of motivation. It is now accepted that the provision of a suitable and stimulating environment can transform a number of children once diagnosed as feeble-minded into reasonably capable adults. Former concepts of the constancy of the I.Q. are equally challenged by Stott's finding that motivational impairment is often made good at puberty. " Boys ineducable until, say, fourteen, acquire the confidence and wish to learn . . . "

Research into motivation has brought out more richly the concept of 'the whole child', a nurture-nature synthesis or interaction, a growing up which interpenetrates with a series of environments, each of which is in part absorbed and all of which are subject to change. There is today a general acceptance of the importance to the teacher of an understanding of child development, of a recognition of the influence of groups, of inner drives and suitable incentives likely to evoke required responses. As Wall has put it, " It would seem that the teacher's task is to accept the declared interests and curiosity of his pupils as a starting point and indeed to use them as far as possible all along the way. At the same time however, he must so arrange the environment that one interest provokes another and that the feeding of interest or the satisfaction of curiosity are made sufficiently easy so that the child can with reasonable effort experience success fairly continuously."

With evidence of this kind drawn from research which ranges from the pre-school to adult years and from the severely handicapped to the normal, there is a clear need to ask ourselves how far practice is still ' tied to out-dated procedures,' how far pessimistically determinist theory retards progress, how far we are making children fit the provision and our estimates of possibilities.

The ' hard core ' of dull and backward

Whilst the I.Q. has been shown to rise under certain suitable conditions and whilst educationists (e.g., Oliver, by means of a concentrated programme of physical conditioning) have shown such rises to be in the nature of a by-product, little has so far been said on the *nature* of that *intelligence* which we measure by tests. There is clearly a need to study in detail and consider the consequences of current research. A series of researches in progress in Israel, reported by Smilansky, reveals a direct frontal attack on the problem of raising ' intelligence.' He and his colleagues accept that the kinds of relational thinking which are measured by intelligence tests can and should be deliberately developed by educational means—especially in those children whose environment is culturally impoverished. This does not mean direct coaching in intelligence tests as such. It means impregnating the education of these children with the kind of processes tested (which *may* be related to the kinds of process tapped by the Illinois Language Development Tests or those which Piaget has not merely described but found to be educable).

The teacher needs to be aware of these exciting new developments—and of the further changes in technique and aim which they prophesy. More experiment must come from the classroom.

Some tentative conclusions

The pre-war concept of *dull and backward* has been considerably modified as a result of closer work with, and study of, the problem. The notion that dullness is for the most part irremediable and the definition of the dull and backward as coming within the 70-85 I.Q. range cannot be accepted today without considerable qualification. A new definition or hypothesis is necessary to match the results of current practice and thinking. An educational assessment is less controversial and more fruitful and involves no departure from the current concept of *educational subnormality*. Meanwhile, the following practical steps suggest themselves:

1. Those we consider to be ' dull and backward ' or slow developers require carefully planned educational provision beginning as early in life as possible. Pre-school provision, particularly for children from economically or culturally deprived homes offers substantial promise. This entails opening kindergartens, nursery classes and nursery schools, notably in such areas as would have been painted black on Sir Cyril Burt's map of backwardness (or Booth's map of crime) had it been extended to cover the country.

2. All children who appear dull or slow should be examined at as early a stage as possible by an educational psychologist well acquainted with the field and, if need be, special nurseries should be set up. (Something more is envisaged here than the special clinics for children who are mentally handicapped.) These would seek, in co-operation with medical and other experts, to minimise the effects of physical and other obstacles to maturation and extend the child's experiences to increase his readiness for the next stage of growth.

3. In the general, initial training of teachers, more attention should be paid to the study of motivation and of maturation in young and in dull children. It is probable that Piaget's concepts of stages and sequences can be helpful here (as envisaged by Woodward) in assessing the stage reached by a child and in aiding him to proceed to the next stage. The notion that one should patiently await maturation might well give way to the idea that maturation can be accelerated—cautiously so that no attempt is made to proceed faster than the child seems temperamentally able to go.

4. There is an urgent need for a *differential* diagnostic test to supplement or replace the more or less global ones in use now. Such a test would attempt to differentiate levels of functioning, distinguish so far as possible discrete aspects of the interaction between the child and his environment, and at least describe in operational terms the effects of any organic defects which remedial treatment may be able to by-pass, to influence or to take into consideration in the teaching programme.

5. At the infant stage the careful development of adequate *motivation* of the child rather than the requirements of the normal infant school may have to be a central

requirement although it is apparent that many children now thought to be in need of special schooling, may prove able to enter the normal school whilst many who might be loosely classified as ' dull and backward ' should prove able to enter the average group. Where necessary, it should be possible to retain the child in the special nursery beyond the ' normal ' leaving or transfer stage, and then place him in a suitable infant school able to take him a further stage.

Within the primary school, even if I.Q. is still used as a broad classifying criterion, organisation must be flexible to allow us to correct errors in diagnosis, to deal with unequal development, and with different rates of maturation at each stage. The traditional practice of giving priority to the setting up of special classes in senior or secondary schools requires to be reversed. It is rather like shutting the stable door after the horse has escaped and is a practice without theoretical support.

6. The importance of language development in the growth of intellectual development and of numeracy in social adequacy makes it imperative that basic subjects (related to outside realities) are seen as basic. The accusation of ' baby-minding ' laid against many special schools and classes abroad derives from the practice of withdrawing troublesome children amongst others from the normal oversized classes rather than selecting children with a view to aiding their growth. Treatment of the apparently ' dull and backward ' at the primary school stage depends in great measure on the head teacher's policy and the organisation he sets up. The merits and otherwise of *streaming*, for example, are largely argued on ' social ' grounds. Streamed and unstreamed schools can prove negative influences on the educationally subnormal child unless the latter's needs are specifically considered and there is a social climate which accepts him as part of the school. This climate is partly dependent on the attitudes of the children with whom the ESN child plays and works. But it depends also upon the attitude of the head and staff. ' Streaming' is still an issue which splits teachers into two camps. In practice however, partisans of either may neglect the *duller* children and sometimes use doubtful theoretical arguments to justify this rather than frankly criticise provision, teacher-training or teaching skill. For example, one head teacher with strong views about the social and religious value of non-streaming and with substantial achievements in the educational attainments of a majority of his pupils, wrote, " About subject teaching, arithmetic, with its progression and its relationship to specific ability and maturation, is the only subject which can offer difficulty in an unstreamed class . . . I advise the teacher not to devote much time to the very dull children with little or no number sense. It's a waste of time—and God always gives these dull ones a sense of money values, so why worry?"

Teachers who face older pupils and young adults who were never helped to overcome their weaknesses in number would challenge this view, although they could appreciate the circumstances which probably drove this headmaster to express it. A disability with number can prove crippling to the personality and such adults can easily become a prey to undesirables—notably where money is involved. At the primary stage—if the child is later to fit into the community without feeling an

outcast or being discouraged from making relationships which aid maturation and personality—specialist attention must be available for every child who is failing generally or specifically in basic subjects. The recommendations of the Advisory Committee on the Supply and Training of Teachers for Handicapped Pupils, are a minimum requirement. One specialist in Educational Subnormality should be on the staff of every primary school.

7. Within the secondary modern and comprehensive schools remedial departments have already demonstrated the value of selecting ESN pupils for special treatment and allowing policy to be sufficiently flexible for those pupils who progress adequately, to be returned to the body of the school. For the less responsive or disturbed, specialist advice should be available along with ancillary provision such as now exists in some areas for primary-school age children. It is interesting to note, for example, the results of such experimental provision as that described by Stott (James Wykeham experiment) or in a variety of ' adjustment ' classes (e.g., Exeter and others). Within a larger authority (e.g., the L.C.C.) it has been possible to provide different forms of special class at the primary stage ranging from ' remedial ' classes, suitably staffed, for bright or average boys who are backward at school, to ' tutorial ' classes for children whose problems are primarily behavioural.

8. A particular weakness of current practice is that a pupil may leave school at 15 (or 16 in a special school) irrespective of his attainments and possibly just at the point when he begins to see a need for learning and is ready to respond. There is a case for a kind of work and study programme to be organised The Bureau for Children with Retarded Mental Development has in New York City, a progressive arrangement with some employers whereby selected children go to school part-time and to work part-time on a graduated scale, the teacher visiting the more backward whilst they are on the job and planning school work on the basis of the extra information and skills the youth requires for his job.

The weakness of provision at the end of the compulsory school period is evident in the lack of reading material for backward youths and the make-shift arrangements to which teachers have to turn in Evening Classes for backward youths (where they exist) and similar centres. The case for prolonging schooling for those with genuine learning difficulties of a general kind is strong. Much might be done even with adolescents and young adults had we the differential tests which revealed the nature and extent of the difficulties and experimentally devised programmes to remedy remediable difficulties. It is probable too that more of such young people would stay on at school were grants available to cover in part the loss of earnings.

9. Research has already revealed something of the influence of pupils upon each other and of teachers' personalities upon the class. We are however a long way from the attempt to work out at each stage or level precisely what we should teach or what processes are required to help maturation, and the best ways of preparing material for the apparently dull child. There is a need for a continuing guidance of

those who have entered on their working life, a case study based on the concept that growth is not a smooth upward curve and that a skilful and timely enrichment of the educational environment may genuinely raise the operational effectiveness, the genuine ability, of many if not all of the dull.

We cannot say what are the limits of a given child's capacity until suitable efforts are made to try to help him attain them.

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TEACHING ARITHMETIC BY CONCRETE ANALOGY—I. MIMING DEVICES (Continued)

by J. D. WILLIAMS

Note: This is the second part of an article that appeared in the February, 1961, issue (Vol. III, No. 2) of this journal

Accessories for Containing and Measuring Number Lengths (Continued)

3. *Number-Tracks*

These are used to measure blocks that are joined end-to-end.

The Stern number-track consists of 10 sections, each of which is 10 units in length. The sections are numbered so that when they are joined together, the number scale from 1-100 is represented. A central groove holds the blocks to be measured, and a jumper, which bridges the track, helps to mark on the scale the position to which the blocks extend. Part of the Stern track is shown in fig. 18.

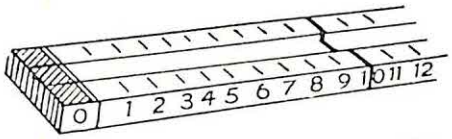


FIG. 18. THE STERN NUMBER TRACK

The Avon '100-channel' carries as many units as the Stern track but is graded only in 10s, and does not dismantle into sections of 10. There is also a '20-channel' for use with smaller numbers. In order to measure the value of the pieces in the Avon channels, the child reads off the value to the nearest 10, and can quickly see how many dots there are in excess of this.

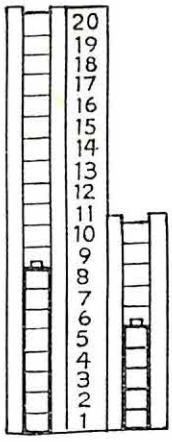


FIG. 19
UNIFIX 1—20
NOTATION AND COUNTING LADDER

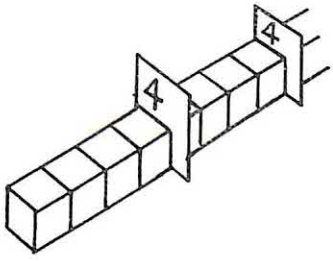


FIG. 20
UNIFIX MARKERS

There is a Unifix 1-20 Notation and Counting Ladder that serves a similar purpose. This consists of a 20-track with a 10-track by its side. Into this 10-track can be placed a block representing the number to be added, or that has been taken away. In addition to this counting ladder, there are Unifix Multiplication and Division Markers which fix between the blocks as shown in fig. 20 and can be used to indicate the number of units lying between them. These can be used with or without the Counting Ladder.

Apart from their obvious uses for adding and subtracting and as a simple measuring device, number tracks have the following special uses:

(i) Teaching counting and notation above 10. The relationship between the number facts in different decades can be very convincingly shown by placing the sections of the Stern track in parallel and bridging across two or more of them with a pencil. Thus, it can be shown that $18-16=38-36=8-6$, etc.

(ii) Multiplying and dividing. In multiplying, a certain number of equal pieces is placed on the track, and the product read off on the scale. In dividing, the dividend is registered on the scale, a number-piece is taken to represent the divisor, and the child ascertains how many of these pieces it will take to reach the level of the dividend. In the Avon number channel this is very convincingly done by inverting the divisor so that its number shows, and then covering up pieces representing the dividend within it. See fig. 21. The multiplication tables can be systematically taught using the number track.

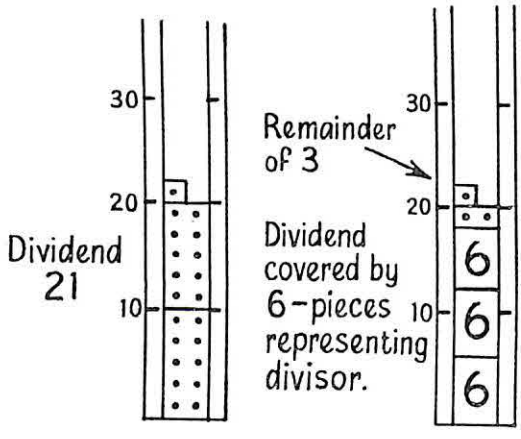
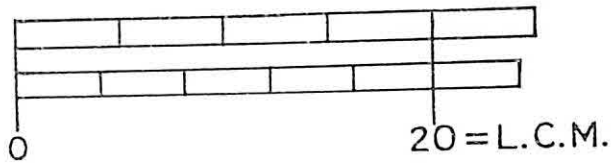


FIG. 21
DIVISION IN AVON NUMBER CHANNEL

(iii) Teaching directed numbers. For this purpose, it is desirable to have two scales progressing away from a common zero point. This can be devised either by re-numbering the track or by placing two tracks end-to-end at zero.

(iv) Using two parallel tracks, or in the case of the flat Avon number pieces, covering one set of lengths by another, L.C.M.s of two numbers can be demonstrated as in fig. 22.



5-PIECES IN FIRST TRACK
4-PIECES IN SECOND TRACK

FIG. 22

4. *Positional Notation Containers*

These are trays with a partition, on the right-hand side of which there is room for no more than 9 units, and on the left-hand side of which there is room for a number of 10-lengths—10 in the case of the Stern, shown in fig. 23, and 5 in the case of the Unifix; in order to demonstrate that ten 10-lengths would form a hundred, and therefore belong to a different position, the Avon container has room for only *nine* 10-lengths.

With the Shaw apparatus, shown in fig. 24, there is a Tens and Units Card to serve this function. This is placed in the slot on a 20-base, and allows 9 units and 9 tens to be structured. Hundreds are represented either by *bundles* of rods or by 10 ten-rods in separate bases; these 100-bases are placed at right-angles to the Tens and Units bases.

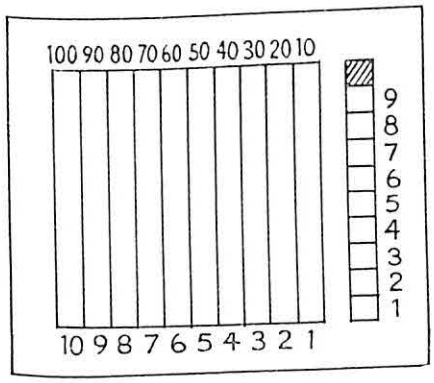


FIG. 23
THE STERN DUAL BOARD

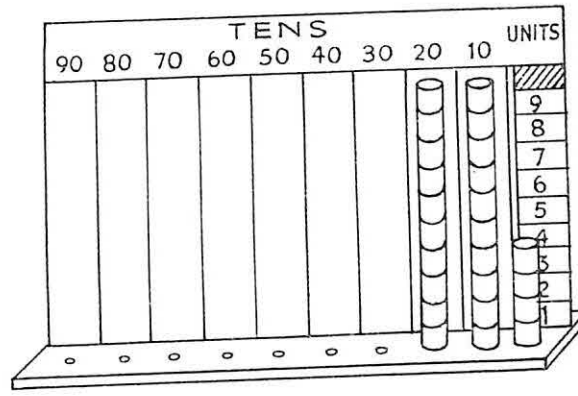


FIG. 24
TWENTY-FOUR STRUCTURED WITH THE SHAW TENS AND UNITS CARD

There is also a shillings and pence card with the Shaw apparatus. This allows 11 units in the pence column and several structures of 12 units in the shillings column.

With the Dienes apparatus no such positional notation containers are provided, but teachers are instructed to make their own. These are not meant to help the child to *measure* at what number to change from one position to another, but merely to indicate where to place the number-pieces.

The positional arrangement of numbers in addition and subtraction examples can

be depicted by using three of these containers arranged below one another as in fig. 25.

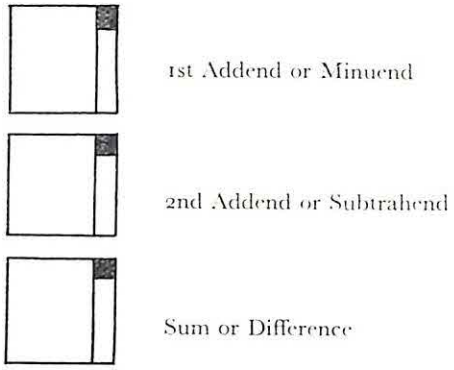


FIG. 25

Such an arrangement of the Avon, Stern and Unifix containers takes up a great deal of space, however, and on this account, the vertical structuring of the Shaw device gives it the advantage. In this case it is necessary merely to place another 20-base in front of that containing the notation card, and you have the three rows required for an addition or subtraction example.

5. *Multiplication Devices using the table of Pythagoras*

The table of Pythagoras is used with many different devices for consolidating and testing the multiplication and division facts.

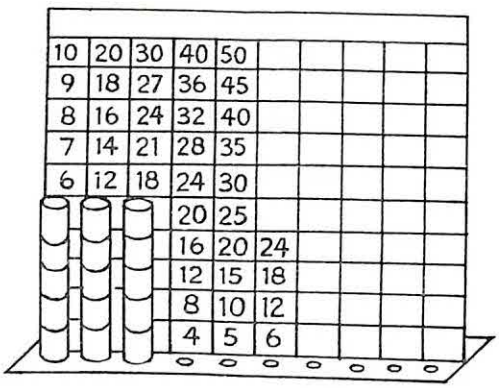


FIG. 26
THE SHAW MULTIPLICATION CHART
SHOWING 3×5

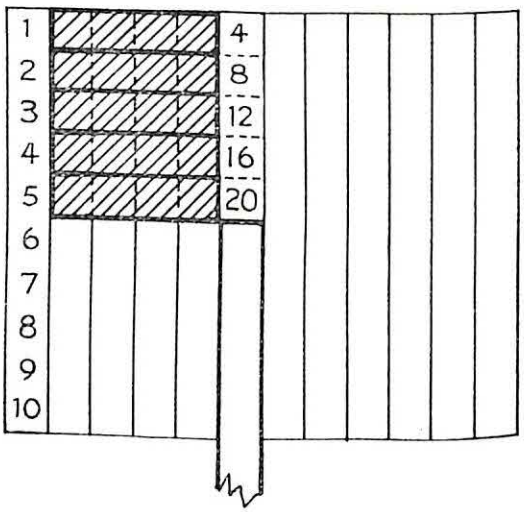


FIG 27
THE STERN MULTIPLICATION
MACHINE

In fig. 26 it is being used with a Shaw base. Three of the 5-rods are placed by the first three columns, and the number the last rod reaches is the product of 3×5. If

one wanted to divide 17 by 5, one would structure rods with 17 units so that as many as possible reached the row beginning with 5, and then one would read off on the bottom row how many complete 5-rods had been structured. Any left over would be the remainder, of course.

Stern's Multiplication Machine is another such device. This consists of a Table of Pythagoras in which numbers progress from top to bottom. The 10 columns are each covered with a movable strip of card, one unit wide. There is an extra column to the left of the table, also 1 unit wide, and a duplication of the first column of the table to the left of this. If 5×4 is required, five 4-blocks are arranged as shown in fig. 27, and the strip that they reach is moved, exposing the number on the table they reach down to. This is their product.

The Montessori version is a board with ten columns of ten perforations into which beads can be placed. A counter is placed by one of the numbers at the tops of the columns to represent multiplicand, and a number slip is placed at the side of the board to represent the multiplier. A number of rows equal to the multiplier are each filled with a number of beads equal to the multiplicand, and the product counted. See fig. 28.

Bass uses a "Convecta Board" on which children build up their own table of Pythagoras with a set of number cards. At the bottom of this board are the numbers of columns 1-10. Writing '1' in the margin to the left, the child fills in the first row, counting in ones. Then, writing '2' above the '1' he fills in the second row, counting in twos, and so on.

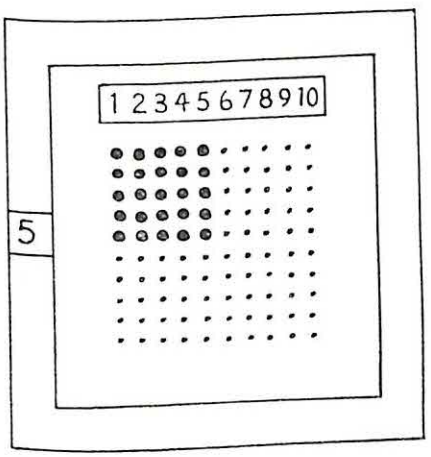


FIG. 28
THE MONTESSORI VERSION

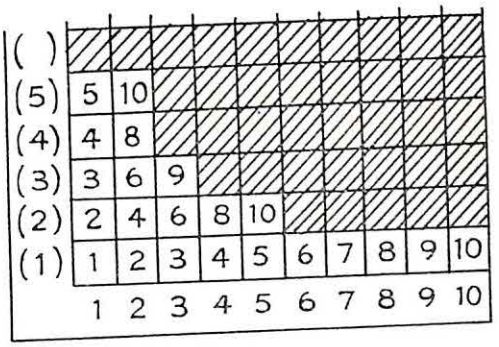


FIG. 29
THE CONVECTA BOARD

6. *Addition Charts, etc.*

The Shaw 100-chart consists of 10 columns, in each of which is numbered one of the decades from 1-100. The bridging of decades can be very clearly illustrated on this. To add a 7-rod to an 8-rod, it would be necessary to add enough units to the 8-rod to fill the first column, and structure the remainder (up to 15) in the second.

The Montessori Addition Strip Board illustrates number combinations up to 18. It consists of a board with columns ruled and numbered from 1-18. There are two

sets of rulers each from 1 to 8 units in length; one set is red, and one blue. The length of each ruler is marked on it. Different combinations of red and blue rulers are placed end-to-end across the columns, and the number they add up to is read off from the top of the last column they cover. Fig. 30 shows a demonstration of $2+4=6$.

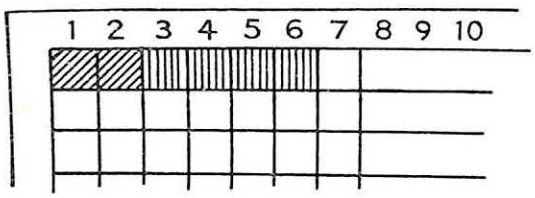


FIG. 30
A BLUE 2-RULE AND A RED 4-RULE, ADDING UP TO 6
ON THE MONTESSORI ADDITION STRIP BOARD

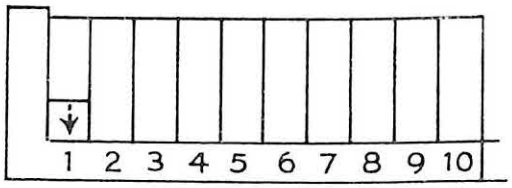


FIG. 31
THE BASS COUNTERPLAY BOARD

7. *The Bass Counterplay Board*

This has numbers 1-10 along the bottom, and ten columns of three spaces to correspond to these numbers. Square counters bearing a dot and an arrow are placed in these spaces with the arrow pointing *towards* the number for addition and multiplication, and *away* from it for subtraction and division. In addition and subtraction, only one row of counters is used; counters are matched with the numbers, and more added or some removed. In multiplication, a number of counters equal to the multiplicand is placed by each number up to that of the multiplier, and then the counters are spread out, one per number, to give the product. In division the counters are gathered up into groups equal in size to the divisor. In fig. 31 there is one counter on the board.

Number Patterns

One way of teaching children how many things a number-symbol stands for, is to get them to associate the symbol with a particular number-pattern. These patterns can be chosen either for the uniqueness of the *gestalt* they present to the child (so that they do not become confused with one another) or for the number-relationships they make clear.

Dominoes bear very distinct patterns, and are therefore not likely to be confused with one another. However, these patterns do not give much indication of the sorts of relationship that can obtain between the numbers they represent. Take the numbers 4 and 8. In the domino patterns often used in schools, an addition 4 + 4 to give 8 would be depicted as shown in fig. 32.

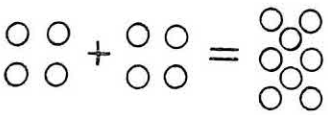


FIG. 32

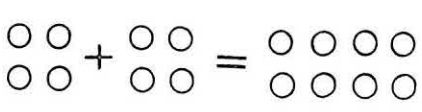


FIG. 33

Two devices, the Stern pattern boards and the Avon number-pieces (see section on number-lengths for description of the latter) sacrifice some uniqueness of pattern for clarity of number-relationships. Thus, in these, 4+4 can be *seen* to equal 8. See fig. 33. In the case of the Avon, these patterns are constantly in front of the child in all of his dealings with the number-pieces. In the Stern, the child can learn the significance of these patterns by trying to fit various numbers of units into them.

An important feature of this sort of number-pattern is that it distinguishes clearly

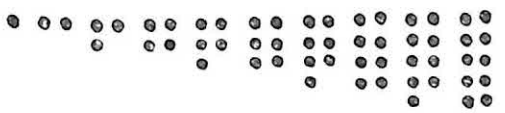


FIG. 34
PATTERNS ON THE AVON NUMBER-PIECES

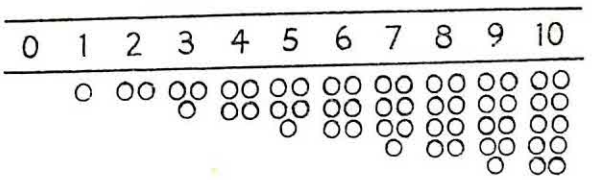


FIG. 35

between even (divided into two equal columns) and odd (divided into two different columns) numbers. In the Montessori system this distinction is made in a different way. A strip bearing numbers 0-10 is placed in front of the child, who is encouraged to set out counters in front of each number in the arrangements shown in fig. 35. The child is shown that he can move his finger between the two columns formed by even numbers, but that its progress is impeded by the extra counter in the case of odd numbers.

Although at an earlier stage the patterning of the units in a number will provide the child with a visual aid to remembering what the cardinal significance of the number is, he will later on need to recognise the number of units arranged in all sorts of patterns. To this end, the pegboard can be used effectively.

The Pegboard

Of the sets of devices that we are considering, this item figures in the Shaw, the Dienes and the Montessori; the ways in which it is used can be related to three characteristics of the peg:

1. differences in colour (with all the pegboards we shall consider, variously-coloured pegs are provided);
2. differences in colour with a numerical significance (in the Montessori system, green stands for units, blue for tens and red for 100s);
3. structurability (the Shaw pegs have this advantage).

There follow some of the uses that can be made of the pegboard.

By grouping a number of pegs into numbers of equal rows it is possible to demonstrate the factors of this number. 12 for example, makes 2 rows of 6 pegs, (or 6 of 2) and 3 rows of 4 pegs (or 4 of 3). The highest *common* factor of two numbers can be found. Thus, of 12 and 8, this would be 4.

Prime numbers can be shown to form only *un*equal rows.

Square numbers form as many rows as the pegs contained in each row.

Important relationships like $A \times B = B \times A$ can be demonstrated by letting the

first letter on each side of the equation represent the number of rows of pegs and the second letter, the number of pegs per row. Taking the pegs in fig. 36 horizontally, it can be seen that A rows contain B pegs each, but, taking them vertically, B rows contain A pegs each. Thus it can be demonstrated that although the number of pegs is constant, this number can be described in two different ways.

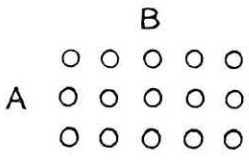


Fig. 36

Again, let short rows of red pegs equal X, and long rows of green pegs equal Y. The arrangement on the pegboard demonstrates that Z (X + Y) = ZX + ZY; in the particular example shown below, Z = 3.

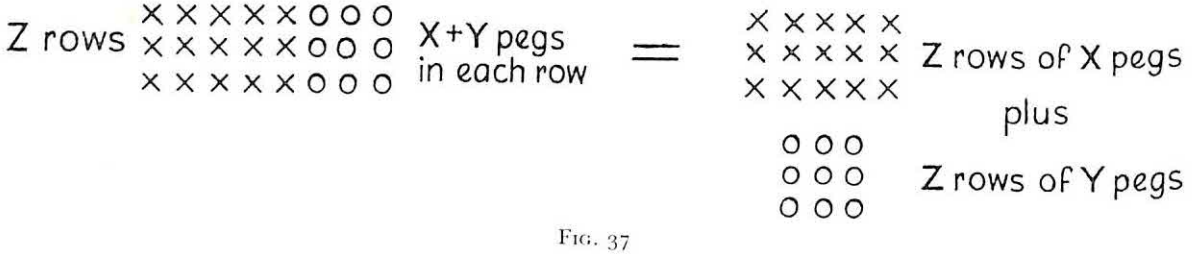
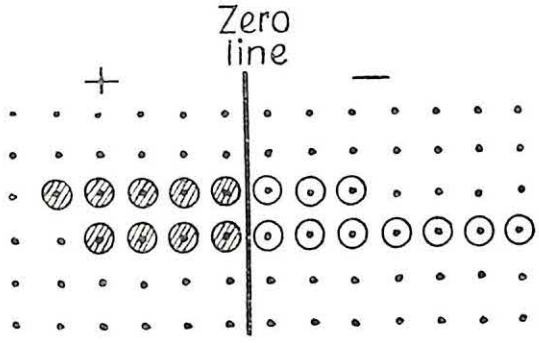


Fig. 37

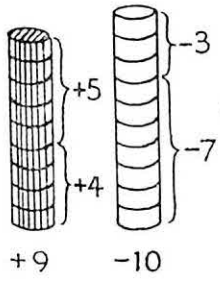
With pegs of two different colours, a scale for demonstrating negative numbers can be devised—using, say, a line of red pegs for the positive numbers, and a line of green pegs for the negative numbers. With pegs that can be structured upwards like those of the Shaw apparatus, positions on this scale could be filled up to the number in question, and then this number could be checked by structuring separately all the negative and all the positive pegs and comparing the resultant structures. See fig. 38.

Thus, one advantage of structurable pegs is that representations by them can be checked either by counting in a horizontal plane or by measuring in a vertical plane; another advantage is that they can be used to depict cubed numbers much more compactly and convincingly than can unstructurable pegs. Compare 3^3 in fig. 39b with the two dimensional representation of it in fig. 39a.

Finally, such expressions as $(a+b)^2 = a^2 + 2ab + b^2$ can be depicted as shown in fig. 40. Where, as in the Montessori system, pegs are given values in units, tens or hundreds, depending on their colour, squares of such two-figure numbers as 25 can be depicted similarly; for $25^2 = (20+5)^2$. Here, the four pegs in the top left-hand corner will each be hundreds, for these represent two *tens* times two *tens*. The twenty five pegs in the



5+4−3−7 shown on the peg board.



= −1, as can be checked by structuring pegs.

FIG. 38

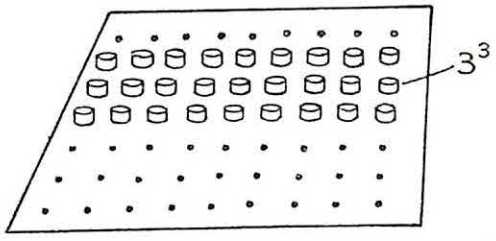


FIG. 39a

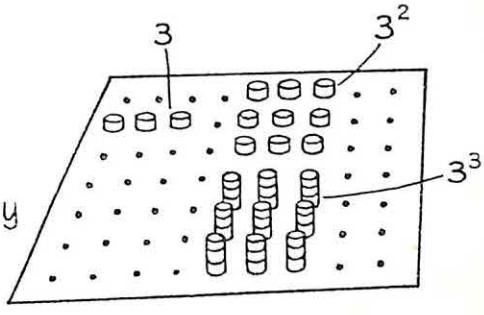


FIG. 39b

bottom right-hand corner will each be units, for these represent five *ones* times five *ones*. The other two pairs of rows will be of 10-pegs, because each pair of these represents five *ones* times two *tens*.

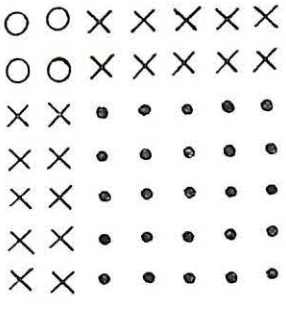


FIG. 40

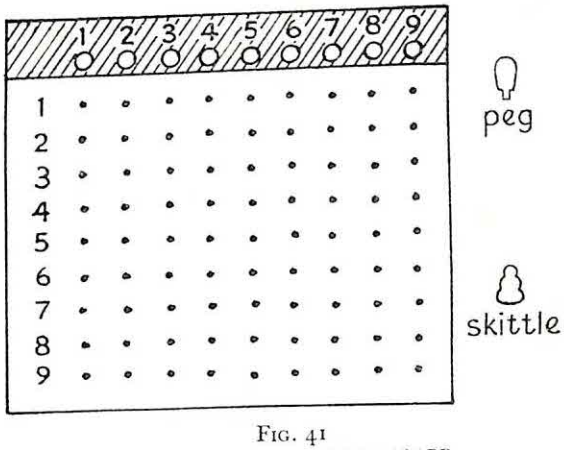


FIG. 41
THE MONTESSORI DIVISION BOARD

The Montessori Division Board is a species of the pegboard. For each column of pegs there is a numbered socket into which a skittle can fit to represent a divisor. A number of pegs equal to the dividend is arranged so that there is a column of the same length under each unit of the divisor, and the quotient (the number of pegs per column) is then read from a vertical scale numbering each of the rows. The board, together with a peg and a skittle, is shown in fig. 41.

Fraction Devices

The use of Number-Lengths

Obviously, the number-lengths can be used for teaching fractions. If $\frac{1}{10}$ needs to be depicted, a 10-length is thought of as the whole, and the unit-length becomes $\frac{1}{10}$. If an illustration of $\frac{1}{6}$ is needed, the 6-length becomes the whole, and accordingly the unit-length becomes $\frac{1}{6}$. But this use of the rods has two disadvantages:

1. The representation of a whole varies with the fraction under consideration; this is not an essential feature of fractions, but inherent in the nature of the device.
2. As a consequence, the fractions formed are not comparable, for $\frac{1}{10}$ is represented by the same unit-length as $\frac{1}{6}$.

Of course these disadvantages *could* be overcome by structuring a 'whole' number length that was equal to the common denominator of the fractions being considered, but such a whole would often be unwieldy.

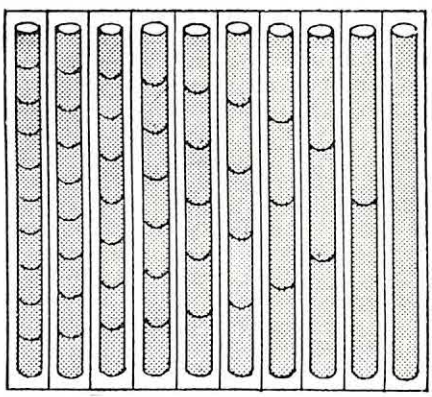


FIG. 42
THE KEIGHLEY FRACTION BOARD

The Keighley fraction board contains a representation of one whole, and the fractions from $\frac{1}{2}$ to $\frac{1}{10}$, in thick, wooden, variously-coloured rods. When other clues are not available, the colour of a part serves to indicate which fraction it represents. These fractional parts can either be compared in the channels in their container, or be stood vertically for comparison. Although this has the advantage over the number-lengths that the fractions are comparable with one another, it is less flexible than the lengths in some ways. Fractions smaller than $\frac{1}{10}$ cannot be represented, so it is not possible to represent some processes involving say both $\frac{1}{2}$ and $\frac{1}{7}$, for these would require a common denominator of 14. By changing the size of the whole, any denominator can be depicted with the number-lengths. The board is illustrated in fig. 42.

Fraction-Measuring Devices

The "Convecta Fraction Board" described in Bass and Dowty's book illustrates very neatly many of the relationships between fractions. It bears 10 equal vertical lines: one undivided line, and others that are divided into fractions from $\frac{1}{2}$ to $\frac{1}{10}$. All the fractions depicted are marked off on a line to the left of the board, and the number of parts (1 to 10) in each fraction-line is marked below it. The fraction lines can be joined horizontally, thus indicating equivalences among the fractions. One can be seen to equal $\frac{2}{2}$, $\frac{3}{3}$, $\frac{4}{4}$, etc. The decimal equivalents of tenths can be seen.

Such a fraction board, though, does not encourage children to find out about fractions by manipulation of objects as does the Stern apparatus. This consists of a set of 10 rectangular frames with transparent fronts, all of the same size. Lines are marked down the fronts, dividing the frames into different fractions. The fraction of the frame up to each line is indicated as shown in the diagram. To each frame there is a set of plates, each the appropriate fraction of the length of the frame. $\frac{1}{2}$ is written on both of

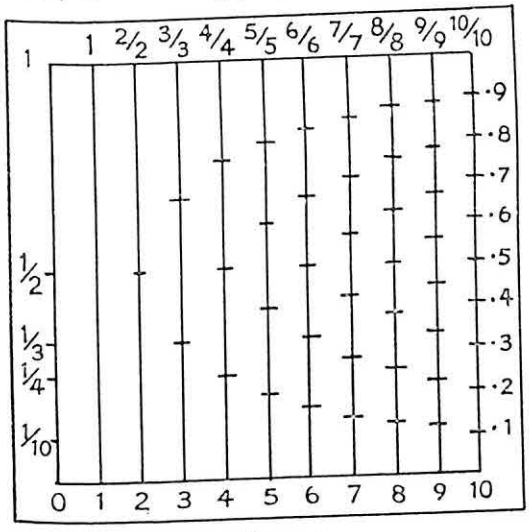


FIG. 43
THE CONVECTA FRACTION BOARD

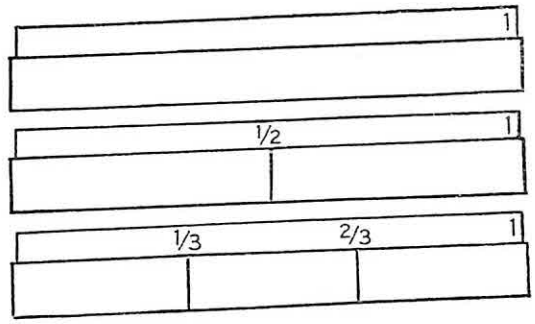


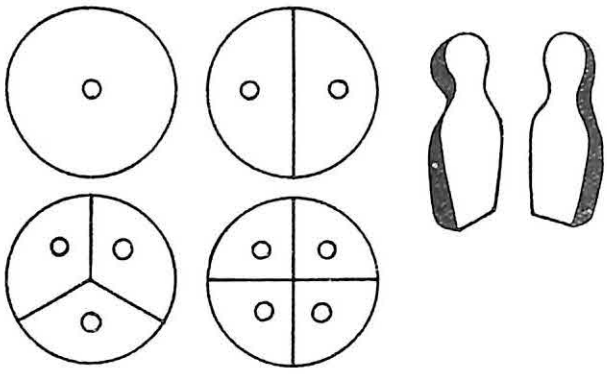
FIG. 44
THREE OF THE STERN FRACTION FRAMES

the $\frac{1}{2}$ plates, $\frac{1}{3}$ on each of the three $\frac{1}{3}$ plates, and so on. Using the frames to measure the plates the child can find out equivalences between the part-plates and the whole-plate and between different part-plates. Children can make their own plates out of cardboard, and, when a common denominator between fractions in two of the frames is not already represented by plates, they can construct out of cardboard fraction-parts to represent it. Three of the ten frames are shown in fig. 44.

Montessori Insets and Skittles

The insets consist of ten metal discs that fit into frames. Each of these is divided into a number of sectors to represent a different fraction. Children can remove sectors from the frames and replace them, or compare sectors by placing some into the gaps left by others.

Large skittles, divided into $\frac{1}{4}$s, $\frac{1}{3}$s and $\frac{1}{2}$s, can be used with these insets to demonstrate



Insets

Divided Skittle

FIG. 45
SOME MONTESORRI FRACTION DEVICES

division of fractions. Thus, to demonstrate $\frac{1}{2} \div \frac{1}{2}$, a sector equivalent to $\frac{1}{2}$ is placed by the skittle. The skittle is then separated into two halves, and the child is asked how much of the sector each half will get. He replaces the half by two quarters and gives a quarter to each of the half-skittles.

Decimals are equated with vulgar fractions with the help of a circular frame divided into hundredths. The sectors are placed in this, and then the number of hundredths each sector equals can be read off.

Shapes of Fractions and Fractions of Shapes

Taught with one or other of these devices alone, children might well fail to realise the diversity of physical embodiments of fractions. Lowenfeld's Poleidoblocs G and A will help them with this realisation. These consist of pieces of wood which bear a simple mathematical relationship to one another, although they are of many different shapes and sizes. For example, the Poleidoblocs G are large coloured blocks, some of which are sections of larger cubes cut diagonally to form prisms, transversely to form slabs, and horizontally/vertically to form pillars. Poleidoblocs A are pieces of plain wood based on a unit $1'' \times 1'' \times \frac{1}{2}''$. This unit is divided into halves (rectangular *and* triangular) and quarters, and also multiplied to form larger blocks, that are $1'' \times 1''$ or $2\frac{1}{2}''$ in cross section, or $2''$, $1''$ or $\frac{1}{2}'' \times \frac{1}{2}''$; some of these are also halved diagonally. Depending on which larger pieces or combination of pieces are taken to stand for the whole, various fractional relationships can be demonstrated between a variety of shapes of wood.

The Montessori apparatus also includes various shapes that can be broken down into fractional parts.

Decimal Fractions

In most of the devices we have considered, tenths are depicted—thus an introduction to decimal fractions is afforded. However, we shall examine the teaching of decimals more fully in a later section, when devices demonstrating the powers of ten will be described.

The Balance

The Dienes Algebraical Experience Materials include a simple wooden balance, on both arms of which are hooks, spaced equally and numbered 1-6 away from the fulcrum. For weights, heavy metal rings are used. The spacing of the hooks is such that X rings on hook Y will balance Y rings on hook X. See fig. 46.

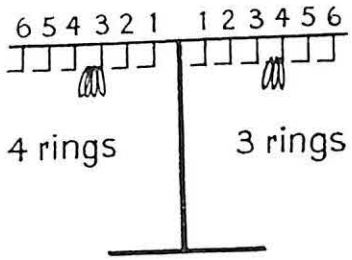


FIG. 46
THE DIENES BALANCE, SHOWING $4 \times 3 = 3 \times 4$

This instrument is good for demonstrating equations, but is at a disadvantage when these involve large numbers, for there is a limited number of hooks and each hook holds only a few rings. Because of this, it is often necessary to represent a number in terms of its components or factors. Thus, 15 might be represented as 5 rings on the 3-hook, or 5 on the 1-hook and 5 on the 2-hook. In this case it would not be very evident that there was *one* term of value 15. Again, three-termed (or more) multiplicative relationships cannot be expressed very clearly. $X \times Y$ can be demonstrated by placing X rings on hook Y, but since there is not room to group rings on the hook, it cannot be shown that X rings have been placed on the Y-hook Z times. Thus, with the balance, it is not always possible to depict clearly the component terms in an expression. For this reason, perhaps this device should be used primarily for *checking* rather than for illustrating calculations.

Further, although balancing is a very convincing demonstration of equality, the rules according to which the arms of the balance are weighted will not be immediately convincing to the child. He will have to *learn* that the value represented by each hook is greater the further its position from the fulcrum. However, once he has learnt to assume this, the device will parallel numerical operations for him quite consistently.

Thus, although this device does involve making some assumptions about the environment that the child would not normally have made before, it parallels number operations much more closely than could the use of colours, for, by virtue of the law of moments, the values of the hooks must be in serial order and be in proportion to their position on the arm; there is nothing intrinsic to *colours* that makes them consistently behave as if they had the cardinal and ordinal properties they must be assumed to have in Cuisenaire's system.

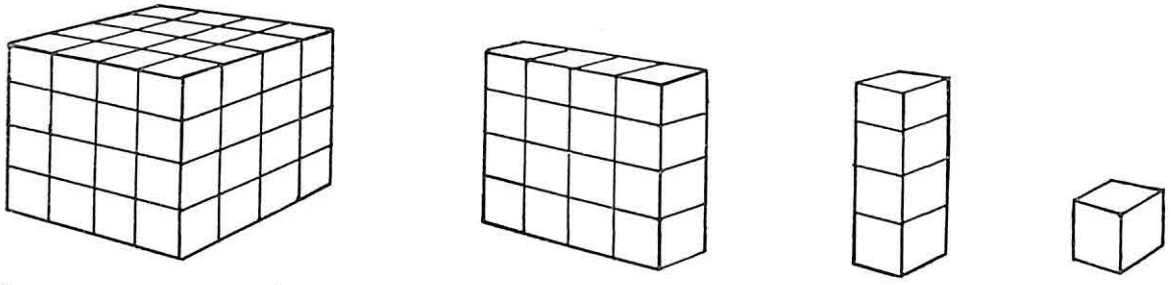
Devices for Illustrating Powers

As pointed out in a previous section, cubes and higher powers *can* be illustrated

in two dimensions (or one, come to that) but the result is visually less easy to appreciate, and, especially in the case of powers of large numbers like 10, much more unwieldy to manipulate than when illustrated in three dimensions. In the devices described below, all three dimensions are used.

Powers of Ten

The Montessori, Stern and Dienes apparatus for depicting these is approximately the same, and the essential components are shown in fig. 47.



Stern	1,000-cube	100-square	10-row	Unit
Dienes	Block (base 10)	Flat (base 10)	Long (base 10)	Unit
Montessori	1,000-bead cube	100-bead square	10-bead bar	Bead

FIG. 47
TERMINOLOGY FOR POWERS OF TEN IN DIFFERENT SYSTEMS

In the case of Stern and Dienes, the unit is a small wooden cube,

the 10-piece = 10 unit cubes in size,
the 10^2 = 100 unit cubes in size,
the 10^3 = 1000 unit cubes in size.

The larger pieces have grooved surfaces so as to give the appearance of being composed of unit cubes.

The Montessori apparatus has a spherical bead for its unit, and the other pieces are actually composed of spherical beads. In the case of the Montessori it is much easier to see that the larger pieces are made of the unit beads, because there are gaps between the beads emphasising the fact that they are discrete, and, in the case of the 1,000 bead cube, exposing the beads in the body of the cube. However, the Stern and Dienes pieces have the advantage that they can be much more stably structured into larger pieces.

The composition of the Montessori 10^2 and 10^3 pieces can be demonstrated by single long bars, made, respectively, of ten 10-bead bars and a hundred 10-bead bars.

With the aid of this apparatus, the structure of the decimal number system can be taught. These pieces can be arranged in the same way as our numbers are arranged —in columns of 10^3s, 10^2s, 10s and units. The reason for carrying and borrowing can be made quite evident, for when there are ten or more pieces in one column it will be *seen* that a piece can be constructed that belongs to the next column up, and when it is necessary to borrow a piece from a higher column, it will be *seen* that this is equivalent to 10 pieces of the lower column.

The special consequences of multiplying or dividing by the base-number, 10, can be demonstrated.

When higher orders, like 10,000, 100,000 and 1,000,000 are needed, composite pieces can be made.

It should be noted that since there are only three dimensions in which to construct these pieces, there will be a recurrence of shapes at every third order of 10. Thus,

1, 10^3, 10^6, etc. are all cubes,

10, 10^4, 10^7 etc. are all *rows* of cubes,

10^2, 10^5, 10^8 etc. are all *slabs* of cubes.

This fact enhances the usefulness of these pieces in illustrating decimal fractions, for, instead of the unit-cube, the thousand-cube can be taken to represent one, so that the hundred-piece will then be in the ·1 position, the ten-piece in the ·01 position, and the unit-cube in the ·001 position.

Powers of Numbers Below Ten

The Montessori and Dienes apparatus includes illustrations of powers for numbers below ten. Thus, for many numbers such operations as multiplying by adding indices and dividing by subtracting indices can be demonstrated.

Dienes illustrates the four rules in number systems to lower bases than ten. He uses the bases 3, 4, 5 and 6, in each of which he has pieces analogous to those in his base-10 set. Thus in his base-3 set a ' long ' is made up of 3 unit-cubes, a ' flat ' of 9 unit-cubes (3^2), a ' block ' of 27 unit-cubes (3^3). An addition in this set would look like this:

	Blocks	Flats	Longs	Units
	1	2	2	1
+		1	2	2
	2	1	2	0

for, in a number system to this base, units would be converted to ' longs ' as soon as there were three of them.

Dienes holds that working in a variety of number systems, like this, children will be able to abstract the *essence* of such concepts as positional value, and disengage these concepts from special features of the particular system in which these are usually practised. However, there is another advantage:

Using number systems to lower bases, the various processes can be illustrated with much smaller numbers. Thus, in the addition sum shown above, no number above 2 was written down, and no number above 3 was thought of. Working with such small numbers, children can actually *see at one glance* when they have enough units to make a ' long,' how many ' longs ' a ' flat ' will make, and so on. This makes the process much more intelligible.

The use of logarithms can be better demonstrated with blocks in a number system to a base less than 10, for roots of 10 (e.g. 10^{-3}) do not lend themselves to simple illustration, and all the whole-integer powers of 10 are (*a*) such large numbers and (*b*) so easy to

multiply together or divide one into the other by the process of re-positioning, that the need for the use of logarithms is not very evident.

The nature of logarithms can be very profitably demonstrated working to the base 3.

These materials have obvious applications to the teaching of measurement of volume.

Some Devices for Teaching Elementary Algebra and Geometry

We have already described the pegboard and the balance. These constitute two of the five different sorts of Algebraical Experience Materials used by Dienes to demonstrate algebraical relationships. Dienes holds that by seeing these relationships in a variety of different embodiments, the child has more opportunity to abstract the underlying concepts. The three remaining devices are:

1. Flat pieces of wood forming: small unit squares 1″ × 1″; strips one unit wide but of two different lengths, neither of which is an exact multiple of a unit; squares of side equal to the length of one or other of the strips; non-square rectangles that are multiples of the units.
2. Flat pieces of wood forming equilateral triangles of side 1-6 inches.
3. Containers of objects. These are not provided, but the teacher is recommended to improvise them (e.g. boxes of matches).

The rectangular pieces of wood can be used to depict many algebraical relationships, in which the small squares represent units, the strips, X, the non-square rectangles, XY, and the large squares, X^2. Since X is no exact multiple of the unit, pupils are not so tempted to think of it as having some particular value, and, because of this, it can be used more convincingly (*a*) as an unknown quantity whose value is to be found, (*b*) as a term whose value is irrelevant to the algebraical relationship being depicted; although the pegboard and balance can be used to parallel these pieces of wood in depicting *many* relationships, they are without *these* two advantages, for on both of these devices all terms must be represented by a number of units.

The triangles afford a spatial illustration of a mathematical square that is not a geometrical square, for 3 one-inch triangles times 3 = one three-inch triangle. They can be used in many other ways to parallel the rectangular depiction of relationships.

Placing things into boxes is a natural way of grouping them into different numbers. An empty box can be used to stand for zero, for an unknown, or for a term whose value is irrelevant.

One would expect that geometrical relationships would be particularly suitable for spatial depiction. Since they are devoted to the description of shapes and sizes, this is so. But it should be noticed that here, the structural device is likely to be exemplifying a particular mathematical description rather than miming a fundamental mathematical operation. The device is often merely a concrete actualisation of the particular shape that the mathematical expression has been invented to describe.

Nearly all of the devices considered so far are admirably suited to deriving the area of a rectangle, particularly devices like the Dienes A.E.M. and the Lowenfeld, in which flat unit squares are provided. These unit squares can be placed over a surface to show

how many square units it will hold.

In his book *From Actions to Operations*, Gattegno describes some uses of the ' Geoboard.' This is a board bearing regularly-arranged nails, over which elastic bands can be stretched to depict a variety of figures.

The Montessori apparatus includes devices for demonstrating how to derive the area of simple figures like the triangle and trapezium. In both cases, components of these shapes are rearranged to form rectangles, as is shown in fig. 48.

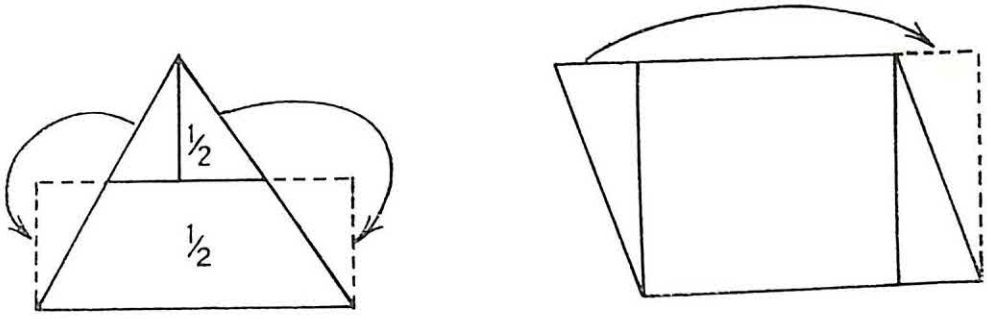


FIG. 48
TWO MONTESSORI DEVICES FOR TEACHING GEOMETRY

As indicated earlier, those devices constructed out of unit cubes, like the Stern, Cuisenaire, Dienes M.A.B., and Lowenfeld, are very suitable for introducing the measurement of volume. Of these, the Dienes and Stern have the advantage that the surfaces of the larger pieces are grooved, so as to indicate composition out of unit cubes.

Conclusion

It has been shown in this article that many of the devices used in teaching primary school arithmetic can be grouped into a few general categories. In a later article it will be seen that there are likewise general procedures common to many of those systems of teaching which make use of these devices.

Some Additional Materials

Since the above was written, information has been received about the following:

The Arithmetic Abacus—L. G. W. SEALEY

This consists of three rows of four vertical shafts mounted on a flat base. Numbers are represented by flat, inch-square counters. These are in four different colours, and have a hole in the centre, to enable them to be structured on the shafts. The three rows can be used to depict the three lines in a conventionally set-out addition, subtraction, or multiplication example—the four columns representing different orders of ten. A different colour of counter is used for each of the different orders of ten.

If, as is usually the case, operations in the *decimal* number-system are to be depicted, the shafts used should be of such a length that only nine counters can be structured on each before it is necessary to exchange these for one counter in the next order of ten. However, by altering the length of the shafts, operations in other number-systems can be performed.

Thus, this device enables the child to parallel in concrete form the written lay-out of many arithmetical operations in a variety of number-systems.

Mathematics Discovery Material—L. G. W. Sealey

This consists of flat red number lengths, 1-10, marked off into units of one inch square. The unit pieces are in two different colours. These can be used in much the same way as was described in the first part of this article. Being flat, they can easily be superimposed.

The Venture Number Apparatus—G. Griffiths

The complete set consists of the following:

1. Number rods from 1-10, marked off on one side into units of a half inch cube. These are made of wood, and, unlike the Stern and Cuisenaire rods, are not differentially coloured.

2. Four number tracks, numbered up to 10, 12, 20 and 36, respectively.

3. Coloured fraction rods to represent eighths, quarters and halves.

4. Two flat 'covering rods,' one to conceal the number-symbols on the 36 track, and the other to measure the fraction rods.

5. Two square trays, on both of which are marked unit squares. One tray holds 100 units and the other holds 144 units. 'Tray cards' can be fitted into the latter, bearing number-symbols from 1-144.

It will be seen that this set of apparatus includes representatives from many of the categories considered above.

Sources

ARNOLD & SON, LTD., 4 Chenies Street, London, W.C.1, supply the Keighley Fraction Board, the Measurement Stair and the Leighbridge abacus.

" AVON " NUMBER APPARATUS—devised by B. R. Jones, Newton Park College, Bath. Obtainable from James Galt & Co., Ltd., Brookfield Road, Cheshire.

BASS, W. G. and DOWTY, O.S., *Counting and Arithmetic in the Infants School*. George Harrap & Co., Ltd.

CUISENAIRE, G. and GATTEGNO, C., *Numbers in Colour*. Heineman, 1954. Materials are obtainable from the Cuisenaire Co., Ltd., 11 Crown Street, Reading.

DIENES, Z. P., *Building Up Mathematics*. Hutchinsons, London, 1960.

DIENES, Z. P., " The Growth of Mathematical Concepts in Children through Experience." *Educational Research*, Vol. II, No. 1, 1959. The materials are supplied by the National Foundation for Educational Research in England and Wales, 79 Wimpole Street, London, W.C.1.

FISHER, D. C., *The Montessori Manual*. Kegan Paul & Co., Ltd., 1914.

GATTEGNO, C., *From Actions to Operations*. The Cuisenaire Co., Ltd., 1958.

LOWENFELD, M., a manual for use with the Polcidoblocs G and A is being prepared and should be ready shortly. These materials, together with an introduction and suggestions for their use, are obtainable from Dr. M. Lowenfeld, 92 Harley Street, W.1.

MONTESSORI APPARATUS. Information on this was generously offered by the St. Nicholas Training Centre, 15 Dawson Place, W.2, and the Montessori Association, 1 Park Crescent, W.1. Materials can be obtained from both of these places.

MONTESSORI, M., *The Advanced Montessori Method. II: The Montessori Elementary Material*. Heinemann, 1918.

SEALEY, L. G. W., *The Creative Use of Mathematics in the Junior School*. Basil Blackwell, Oxford, 1961. Materials are obtainable from H.C.P. (Products) Ltd., 32, Churchgate, Leicester. This firm also produces the Venture Number Apparatus, and a balance similar to that used by Dienes, but with 9 hooks on each arm instead of 6.

SHAW, H., a manual for use with these materials has been prepared and is awaiting publication. The materials (" Structa " apparatus) are obtainable from James Galt & Co., Ltd., Brookfield Road, Cheadle, Cheshire.

STERN, C., *Children Discover Arithmetic*. Harper & Bros., New York, 1949. Materials are obtainable from The Educational Supply Association, 181 High Holborn, W.C.1.

UNIFIX MATERIALS are supplied by Philip & Tacey, Ltd., 69-79 Fulham High Street, London, S.W.6.

Note: The author would be grateful for any information about variants of the materials described, or other kinds of material. Please address communications to J. D. Williams, N.F.E.R., 79 Wimpole Street, London, W.1.

Research Note:

LENGTH OF SCHOOLING AND ITS EFFECT ON PERFORMANCE IN THE JUNIOR SCHOOL

by D. A. Pidgeon and Evelyn M. Dodds

Introduction

THERE is a general, but not universal, rule in this country that children start formal schooling at the beginning of the term in which they will become five years old. This means that, according to their birth date, children will commence their Infant schooling on one of three dates in the year. Subsequently, however, transfer to a Junior school where it occurs, and the later transfer to a Secondary school, takes place only at the beginning of the school year, and again the general rule is for those children to be transferred who will have reached the promotion age by September 1st or some date near this. It follows, therefore, that all children do not spend the same time in Infant or Junior schools and the difference can in fact amount to one whole year.

For example, a child who was born in July 1952 may start school in the Summer Term 1957 and will be due for transfer to a Junior department in September 1959, having completed 7 terms of Infant schooling only. Another child, however, born in September 1952 and starting school in the Autumn Term 1957 will only be 6 years 11 months old on September 1st 1959 and will therefore stay one further year in the Infant department. This child will not be due for transfer to the Junior department until September 1960, having completed 9 terms of Infant schooling. The extreme case can occur for two children born each side of September 1st—perhaps only a few days apart in age. Both children may start school together in the Autumn Term, but the one born before September 1st will complete only 6 terms of Infant schooling before being transferred to the Junior school, whilst the other will complete 9 terms. This difference in length of schooling persists, of course, so that in the extreme case just quoted one child may receive 6 years of schooling (2 Infant and 4 Junior) before being transferred to a Secondary school, whereas the other may receive 7 years of schooling (3 Infant and 4 Junior).

Teachers have been aware of this difference, yet little work appears to have been carried out to discover what effect, if any, it has on later performance. Many have suggested, not unreasonably, that within any given year group, the children who have received more schooling will have learned more and hence when examined will produce better performances. However, it must also be realised that, again within any one year group, children differ in age by as much as 12 months, and when examined at any time during a year it is the older children who have also received longer schooling. Hence, if differences in performance are found amongst children with different lengths of schooling, these differences may be due at least in part to differences in age. Equally, of course, differences in performance found amongst children of different ages may be due to differences in the amount of schooling they have received as well as to the fact that some are older than others.

First Investigation

In the endeavour to sort out some of the intricacies of this problem the Foundation carried out two small investigations. A number of primary schools assisted in these studies and their help and co-operation is gratefully acknowledged.

The first investigation was carried out in a Junior school in which the children were streamed by age—that is, they were grouped in classes according to age in the contributing Infant school and the Junior Headmaster accepted these groupings and maintained them throughout his school. In order to obtain a measure of performance, all the children in each of the four years of the Junior school were given, in the Spring Term 1959, the Foundation's Sentence Reading Test 1. The median raw and standardised scores together with mean ages and age ranges of the four year groups are given in Table I.

Table I

MEDIAN SCORES BY YEAR GROUP

Year	Classes	No.	Age Range	Mean Age Yrs. Mths.	Median Raw Score	Median Stand. Score
1st	1 & 2	62	7:5— 8:4	7 10.02	10.00	93.30
2nd	3, 4 & 5	87	8:5— 9:4*	8 10.80	13.38	89.40
3rd	6, 7 & 8	104	9:5—10:4	9 10.91	26.00	100.00
4th	9 & 10	80	10:4—11:4	10 9.74	28.15	99.50

*one child of 9:9

Class 5 was an exception to the rule of 'streaming' by age since it contained all the poor readers from the 2nd year group.

The standardised scores (mean 100, S.D. 15) contain an age allowance determined from the sample on which the test was standardised. The median standardised score for each year group was then used to determine what would be the expected median raw score for each class within the year group. This expected median raw score was then compared with the observed median raw score. If the classes had been grouped by age only—that is, within each class there was a full range of ability—then the observed and expected median raw scores should be approximately the same. Similarly, of course, the median observed standardised score for each class within a year group should be approximately equal to that for the year group as a whole. The results are given in Table II. In order to complete the analysis the children from Class 5 were distributed into Classes 3 and 4 according to their age.

Table II

MEDIAN SCORES BY CLASS GROUPS

Class	No.	Age Range	Mean Age Yrs.	Mean Age Mths.	Expected Median Raw Score	Observed Median Raw Score	Observed Median Stand. Score
1	31	7:5— 8:0	7	7.26	8.46	9.25	96.38
2	31	7:8— 8:4	8	0.77	12.05	12.25	96.00
3 & 5	50	8:5— 9:1	8	8.50	12.26	8.83	84.50
4 & 5	37	8:9— 9:4*	9	1.92	14.66	20.88	98.88
6	36	9:5—10:4	9	8.36	24.94	19.50	91.50
7	34	9:6—10:4	9	10.44	25.65	25.83	101.00
8	34	9:9—10:4	10	2.09	26.70	28.50	104.00
10	39	10:4—11:3	10	8.44	28.05	26.13	94.67
9	41	10:6—11:4	10	10.98	28.39	29.60	103.67

*one child of 9:9

It will be seen from Table II that there was not a great deal of discrepancy between expected and observed scores for Classes 1 and 2 in the first year group. The observed scores for Class 3, however, are well below expectation, while those for Class 4 are well above. The difficulty with Class 5 may have contributed to this discrepancy, but the same phenomenon occurs with the three classes in the 3rd year group and also with the two classes in the 4th year group.

However, it will be seen that the age 'streaming' is by no means exact—there is considerable overlap in the age ranges for each class in a year group. This was due to the presence of a few children only and therefore the results for the 3rd year group were re-calculated and the analysis confined to those children falling within a five month group in each class. The results are given in Table III.

Table III

MEDIAN SCORES FOR 3RD YEAR GROUP

Over-all Mean Age 9 years 10.77 months; Median Raw Score 26.86; Median Stand. Score 102.00

Class	No.	Age Range	Mean Age Yrs.	Mean Age Mths.	Expected Median Raw Score	Observed Median Raw Score	Observed Median Stand. Score
6	29	9:5— 9:9	9	7.10	25.56	22.00	95.25
7	31	9:8—10:1	9	10.52	26.56	26.00	101.67
8	31	10:0—10:4	10	2.45	27.61	29.63	108.67

It is still clear from the figures in Table III that Class 8 is doing considerably better than their average age indicates and Class 6 not as well.

A satisfactory explanation for these differences could not be found in any differential treatment of the various classes within a year group. That is to say, all classes within a year group in the school were treated as ' parallel ' and a careful balance of the teaching strength was always maintained. Indeed the only plausible explanation seemed to be one associated with the length of schooling. Information was obtained on this variable for most of the children in the 3rd year group and this showed that for the most part Class 6 had received 13 terms previous schooling and Class 8, 15 terms.

It must be made clear that this investigation was carried out in only one school and a relatively small number of children were concerned. However, the results showed that in a school where children were ' streamed ' by age, older children scored higher on the average on a reading test than might have been expected according to their age, while younger children did not perform as well. Furthermore, the findings were in the direction expected from the hypothesis that an extra term or two of schooling would result in improved performance.

Second Investigation

Following an article in an earlier issue of this Journal on the *Effects of Streaming** a number of primary school head teachers interested in this topic wrote to the Foundation expressing their willingness to co-operate in any relevant research. Although the problem

*Vol. II, No. 1, November, 1959.

of length of schooling was distinct from that of streaming, these schools together with others, readily agreed to participate in a further investigation which, it was hoped, would provide more definite evidence. Six Junior schools in all were asked to administer Sentence Reading Test 1 to all children in their four year groups, and to obtain for each child a record of the number of completed terms previous schooling up to the time of testing. A total of 1,604 children were tested and the relationship examined between reading performance and the number of terms previous schooling.

Before considering any effect due to the age of the children, it was found that, within schools, there was a highly significant regression effect of raw scores on the reading test, on the number of terms previous schooling. Using this regression the expected mean reading scores for given lengths of schooling may be calculated and the results of this are given in Table IV.

Table IV

RELATION BETWEEN THE NUMBER OF TERMS PREVIOUS SCHOOLING AND RAW SCORE ON SENTENCE READING TEST 1

No. of terms previous schooling	8	10	12	14	16	18
Expected raw score on S.R.1.	13.32	16.23	19.15	22.07	24.99	27.91

Quite clearly reading test performance is affected by the length of previous schooling. After the effects of the age of the children has been eliminated, however, the regression of test score on length of schooling becomes statistically non-significant (taking the usual 5% significance level). The predicted reading scores for different number of terms schooling *after the elimination of the age effect* are given in Table V.

Table V

RELATION BETWEEN THE NUMBER OF TERMS PREVIOUS SCHOOLING AND RAW SCORE ON SENTENCE READING TEST 1 AFTER ELIMINATING EFFECTS OF AGE

No. of terms previous schooling	8	10	12	14	16	18
Expected raw score on S.R.1.	17.98	18.97	19.96	20.95	21.95	22.94

A comparison of Tables IV and V shows that the change in score that may be expected for an increase of one term's schooling has decreased from approximately 1.46 to 0.50 points of score, when age is eliminated. This second figure is no longer large enough to be described statistically as significantly different from zero.

The regression analysis was also carried out on the results for each school separately. It was found that the regression of reading score on length of schooling remained statistically significant, after the elimination of age, in only one of the six schools. This was a large three-stream school which, for the most part, ' streamed ' by age within each year group. The regression for this school was found to be significant at the 5% level, while the results for the remaining five schools agreed with those obtained on the total.

These results indicate that while length of schooling is obviously related to reading performance ($r = 0.539$) there is such a close correspondence between length of schooling and age ($r = 0.979$) that, to allow for age when considering test score also allows for differences in length of schooling.

This analysis seemed conclusive enough; there remained the possibility, however, that any residual effect from the length of schooling might only be apparent during the early years of the Junior school and that by carrying out analyses over all four years the effect was masked. These regression analyses were repeated, therefore, covering the first two and the last two years of the Junior school separately. Two schools were omitted from these calculations, since their data were incomplete.

The first repeat analysis was carried out on the first and second years of the Junior school. Before the ages of the children were considered, it was again found that, within schools, there was a highly significant regression of raw reading score on the number of terms previous schooling. However, when the effect of the ages of the children was removed, it was found that no statistically significant regression remained.

This regression analysis was also carried out on the first two years of each school separately, but the same result was found for each. Thus it is clear that variations in length of schooling have no residual effect on reading performance during the first two years of the Junior school once the effects of differences in age are allowed for.

For the third and fourth years the regression of reading score on the number of terms previous schooling was also highly significant before age was considered. When the effects of age were eliminated, again the regression was no longer statistically significant. The repeat of the analysis for each school separately, however, gave results for two of the schools which agreed with those for the totals, but for the other two schools the number of terms previous schooling still had a significant effect on reading scores, even after the elimination of age.

It will be recalled that most of the schools participating in the investigations were interested in the problem of streaming and in fact only one of the four schools in the last analyses was streamed by ability. In this school there was no residual effect of length of schooling. One other school practiced no streaming at all. It was a large school and except for one ' fast ' class in both the third and fourth years, in all other classes the children were grouped at random. This school also showed no residual effects of length

of schooling. In the other two schools, however, streaming, not by ability but by age, was practiced and in both these schools the residual effect of length of previous schooling on reading performance was significant after the elimination of age. It is interesting to note that this result agrees with the first investigation reported above, in which the school concerned also streamed by age.

Discussion of Results

The number of schools participating in this investigation was fairly small and since the results seem to depend upon the type of streaming practiced in each school the findings must be reviewed with caution. There appears to be evidence, however, to suggest that under the usual circumstances pertaining in most schools, if due allowance is made for the age of each child when tested, then due compensation will also be given for any differences that might exist in length of previous schooling. Where the practice of grouping children into classes according to their age is adopted, the evidence from both investigations reported here suggests that even after due allowance is made for the age of the children, their reading performance still varies according to the length of previous schooling they have received, although this residual effect appears only to be noticeable during the latter part of the Junior school.

The explanation of these results is not easy to find. The fact that this residual effect only appears in the latter part of the Junior school makes the hypothesis that it is due purely to length of previous schooling questionable. If the latter is to have an effect on test scores after age has been considered, then it would surely be more noticeable with younger children, that is, in the early years of the Junior school. It will be observed, however, that under these circumstances of 'streaming' by age, the older children in a year group, who happen also to be those who have received a longer schooling, perform better than is expected of children of their age, while the younger children in the year group perform below the expectation for their age. The possibility must be considered, therefore, that the differential performance effect is not due to any differences in length of schooling, but to the fact that the children are 'streamed' by age. Some evidence has already been obtained that one of the effects of streaming is to increase the 'spread' of test performance*. That is, under the circumstances of ability streaming, more high scores and also more low scores are produced than would be the case were the children not streamed.

The suggestion here is that since older children of a year group will be doing more advanced work than the younger ones, simply by reason of their age, an older stream will give the appearance of being 'better' than a younger stream. This in turn may result in the tendency, as with ability streaming, of advancing the older children and retarding the younger ones. Since this 'advancing' and 'retarding' would be cumulative it is possible that its effect would not be noticed during the early years in the Junior school, but it would become more apparent as children reached the third and fourth years.

*A Comparative Study of Basic Attainments. Educational Research, Vol. I, No. 1.

Although the evidence from the investigations reported here would support such an hypothesis as this, it should be made clear that it by no means confirms it. Clearly, considerably more evidence is required. During the Foundation's 1960 National Survey, information on the number of terms previous schooling has been obtained from representative samples of 7-8 year old children in England and Wales together with the children's performances on a number of arithmetic and reading tests. A full examination of this data may well throw some further light on this question. Still further evidence will be required, however, especially from Junior schools where children are streamed by age within each year group. If any Junior school which practices age streaming is interested in co-operating in a further enquiry, the Foundation's staff would be willing to organise it and to analyse and report the results.

Research Note:

THE IMAGE OF TECHNICIAN OCCUPATIONS AMONG SCHOOL-LEAVERS

by STEPHEN COTGROVE
Senior Lecturer in Sociology, The Polytechnic
and FRANK BARR
Senior Lecturer in Education, Huddersfield Technical Teacher Training College

IN recent years, there has been a growing recognition of the importance for industrial advance of the middle range of qualified manpower, above the level of craftsmen, but below that of technologist. Moreover, a number of enquiries have shown that the shortages in this range of technician occupations are comparable to those at the higher levels. A shortage of qualified draughtsmen appears to be particularly acute.

There are, however, a number of factors which may be influencing recruitment to this type of occupation. No clear channels of recruitment and training exist for technicians in industry comparable to apprenticeship for craftsmen. Indeed, it is only in the last few years that the word technician has come to be used to identify such occupations. Previous enquiries[1] have shown that school children lack vocational knowledge. It could be expected, therefore, that they might be even less informed about technician occupations. The following report summarises the main findings of a small pilot enquiry to discover the 'image' of technician occupations among school-leavers.

The Enquiry

Three schools co-operated in the research: one comprehensive, a secondary technical and a secondary modern. Replies were received from 149 boys in their final year at school, of whom 85 were in a secondary technical school or in technical streams, 33 in grammar and 31 in modern streams. The total sample is, therefore, likely to be rather more interested in, and better informed about, technical occupations than the total population of school leavers.

A majority of the school-leavers in the sample had already chosen a career in industry, and of these 20% had chosen draughtsmen or engineering apprenticeships, while a further 12% aimed at the professional technologist level (see Table I).

[1]For a summary of previous enquiries into vocational interests, see "Interest Testing in Educational and Vocational Guidance," S. Weigersma & F. Barr, *Educational Research*, Vol. II, No. 1, 1959.

Table I
Choice of Occupation Analysed by Streams

	All %	Grammar %	Technical %	Modern %
Apprenticeship—trade	13	—	19	10
—technician	20	3	33	3
Non-apprenticed learner	24	21	17	45
Professional—Sci./Tech.	12	28	8	3
—business	4	6	4	3
Clerical	12	30	8	3
Miscellaneous	15	12	11	33
	100 (147)	100 (33)	100 (83)	100 (31)

A series of questions and tests was devised to explore the image of technician occupations among the sample. In a word-association test, the words most frequently checked as applicable to such occupations were 'qualified,' 'interesting,' 'brain-work.' A majority (75) thought of the technician as a man in a white coat, compared with 33 whose image was of blue overalls. But 70 also thought that he worked with his hands. The social-class position of the technician seems, however, to be ambiguous. Opinions were equally divided in calling him middle class (41) and working class (42). But when asked to rank 7 occupations in order of status and pay, draughtsmen were ranked second in both cases (Table II).

Table II†
Occupations ranked in order of pay and status

	Pay	Status
Civil Servant (exec.)	1	1
Draughtsman	2	2
Insurance Agent	3	5
Laboratory Technician	4	4
Carpenter	5	6
Primary School Teacher	6	3
Wages Clerk	7	7

Rank order correlation = 0·77

†Three occupations (civil servant, insurance agent and teacher) were included to make possible comparison with the Hall-Jones enquiry into the ranking of occupations (see D. V. Glass, *Social Mobility in Britain*, Ch. 2). The relative order of ranking of these occupations by the sample of school-leavers corresponds to the adult ranking. For a report of a more detailed study, see H. T. Himmelweit, A. H. Halsey and A. N. Oppenheim, "The View of Adolescents on some Aspects of Social Class Structure." *Brit. Journal Soc.*, Vol. III, No. 2, 1952.

This generally favourable image is confirmed by the replies to a sentence completion test. The majority thought technicians to be well or highly paid (65% of responses). 56% thought of technicians' jobs as skilled, intelligent, qualified, interesting, while 75% thought that in ten year's time, technicians would be better/highly paid.

Broad occupational interests and preferences were explored by asking, " If you had to choose between a job in either list *a*, *b*, or *c* below, which would you choose?" The lists comprised:—

(*a*) Clerical and office occupations (e.g., bank clerk, railway clerk);

(*b*) Technician (e.g., draughtsman, maintenance engineer);

(*c*) Skilled trades (e.g., carpenter, bricklayer).

The majority (61%) stated a preference for the technician list; the rest were equally divided between office jobs and trades. About the same proportions also ranked jobs in the technician list as most interesting, secure, useful and worthwhile, although trades were ranked rather higher than office jobs as useful and worthwhile. The final question asked was " For which list of jobs do you think it is most important to go to evening classes if you want to get on?" Here 70% stated the technician list, 25% the trade list, but only 5% office and clerical jobs.

There were however some differences between streams. Table III shows that although a majority in all streams ranked technicians' jobs as the most interesting and secure, the technical streams ranked them most often as interesting, and the modern streams as the most secure.

Table III

Image of occupations analysed by streams

	Grammar		Technical		Modern	
	Interesting %	Secure %	Interesting %	Secure %	Interesting %	Secure %
Office/clerical	33	19	6	21	7	11
Technicians	58	69	80	53	57	75
Skilled crafts	9	12	14	26	36	14
	100 (33)	100 (32)	100 (80)	100 (77)	100 (28)	100 (28)

More boys had stated a preference for technician jobs than had decided to enter technician apprenticeships, and such occupations were ranked high for interest, pay and security. What reasons then were given by those who did not state a preference for the technician list? By far the most frequent type of explanation was " too educated for me," " need a lot of study," " I could not do that," " too brainy," " science weak subject," " good jobs but too many exams."

This image of technician occupations as those which require study and qualifications was explored by a series of questions as to the type of education and qualifications necessary for such jobs. 90% thought that technicians will have attended classes after leaving school, and two thirds thought that this would mean part time study at a technical college. Most had heard of National Certificates, City and Guilds, and the B.Sc. degrees, but only half had heard of a Dip.Tech. Most thought that the ONC was harder than G.C.E. ' O ' level. G.C.E. ' O ' level was mentioned most often as the qualification likely to be possessed by the average technician. But there were interesting differences between streams. The modern stream sample mentioned National Certificate and City and Guilds much less than the total sample (9% of replies compared with 43%), but believed G.C.E. to be the qualification of the average technician much more frequently (69% compared with 41%). The technical stream on the other hand mentioned national certificates and C. & G. more frequently (59%) and G.C.E. less frequently (26%).

Finally, as entry to technician jobs is usually via apprenticeship, attitudes towards this form of entry to occupations were explored. About two-thirds of the sample were prepared to become apprenticed. But again there were marked differences between the streams. While 77% of the technical streams were favourable, only 21% of the grammar streams would enter on apprenticeship. Among the main reasons given by those who favoured apprenticeship, most stressed the training which was achieved, followed by the better chances of getting on. Those who were opposed referred to the low pay and being ' tied down ' in apprenticeships.

It can be seen that for this particular sample of school leavers, technician jobs are ranked highly in terms of pay, status, interest and educational achievement. The image is, if anything, rather too favourable. Recent enquiries show that in fact only about half the technicians employed in industry have an educational qualification[2]; while the average pay of those holding an HNC is little higher than that for skilled craftsmen[3]. But the sample used in this inquiry included a large proportion of boys in secondary technical streams; and on several issues, it has been shown that their replies differed from those of grammar and modern streams. Are there, then, any specific factors which can be shown to account for these differences between streams?

The size of the sample does not justify any very refined analysis of the variables, but some differences are sufficiently great to be significant. Table IV shows job preferences analysed by streams. The preference of the technical streams for technical jobs and of the grammar streams for office and clerical jobs is very marked.

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[2]S. F. Cotgrove, " Technicians in Industry." *Technology*, Nov.-Dec., 1960.

[3]G. Thomas, *The Higher National Certificate*, 1952. *Central Office of Information*, August, 1960.

Table IV
Occupational preference analysed by streams

	Grammar %	Technical %	Modern %
Office, clerical	53	11	8
Technician	41	71	56
Skilled crafts	6	18	36
	100	100	100
	(32)	(82)	(25)

This does not tell us of course, what factors led the boy to choose a technical stream in the first place. It may be that entry into a technical course stimulates vocational interests, or possibly that only those whose interests lie in the direction of careers in industry choose to enter the technical streams. Choice of streams cannot be explained by any simple association with fathers' occupations. Indeed, a much higher proportion of boys in the technical than in the grammar streams were the sons of men in business and clerical occupations (Table V).

Table V
Streams analysed by Fathers' occupations

Fathers' Occupations	Grammar %	Technical %	Modern %
Non-manual:			
Industrial/technical	40	25	6
Business/clerical	18	30	6
Manual:			
Skilled	24	35	49
Other	18	10	39
	100	100	100
	(33)	(81)	(31)

Further study would be necessary to explore how far the grammar and technical stream curricula are themselves responsible for generating the occupational interests and evaluations which have been demonstrated.

Summary and discussion

The sample of boys in their last year at school ranked technician occupations highly, relative to office and craft occupations. The typical image of the technician is of a man in an interesting, well paid, secure occupation, held by an educationally qualified man. Indeed, the educational requirements believed to be necessary are, for some, a barrier to entry. By comparison with actual conditions in industry, this image exaggerates somewhat both the pay and the qualifications of typical technicians.

There were, however, important differences between streams. Although all streams ranked technician occupations highly by the various criteria, a majority of the grammar school stream would prefer a job from the clerical/business list, and only 3% had actually chosen to enter a student/engineering apprenticeship (compared with 33% of the technician stream). A higher proportion of the technical streams thought of National Certificates and C. & G.'s as typical technician qualifications. The technical streams stood out as ranking technician occupations more highly, being better informed on their educational requirements, and as having more often chosen to enter such occupations.

Several tentative conclusions may be suggested. The proportion having chosen to enter technician occupations is small compared with what might be expected from the favourable image towards them (Table I). The reasons for this are not clear, but it does indicate that a very substantial potential supply of technicians exists. It should also be noted that only 21% of the grammar school stream were prepared to enter an apprenticeship—the typical means of entry to many technician occupations.

The very marked orientation towards technician jobs to be found in the technical streams is perhaps to be expected from previous studies. But how far this is due to the curriculum in the technical streams, or how far such an orientation itself determines the entry to technical streams is a problem which requires further study.

Bibliography:

THE TEACHING OF ENGLISH LITERATURE IN SECONDARY SCHOOLS

by M. K. Paffard

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This list is supplementary to Sheila Bate's bibliography "The Teaching of English in Secondary Schools" published in *Educational Research*, Vol. II, No. 3, June 1960, in which language was emphasised rather than literature. Many general books on the teaching of English mentioned in her list contain useful sections on the teaching of literature and these references are not repeated here.

For reasons of space this is necessarily a *select* bibliography. The titles are roughly grouped under headings and in each group I have attempted to include all the more useful and up-to-date books known to me, though no guarantee is offered that all the titles are still in print or easily obtainable. It has proved impossible to draw a hard and fast line between, on the one hand, methodological books written for teachers or students of education and, on the other hand, more general books on literature, school text books, and books written for young readers. Books in the second category are very numerous and I have tried to select those which seemed to me sufficiently useful or original in approach to justify their inclusion.

Articles are not included: they are so numerous that a selection within a reasonable compass would inevitably seem arbitrary; instead, a list of the most useful periodicals and a bibliographical section are included. I should have liked to include a section devoted to books on the mass media of communication through whose channels so much literature nowadays reaches children and adults alike. This has proved impossible for reasons of space alone and not because the subject does not seem to me of the greatest importance. I hope to expand on this and other controversial points in a subsequent number of *Educational Research*.

I have commented on a book in this bibliography only when this seemed desirable because of its importance or necessary because its title might be misleading. My comments attempt to be factual rather than evaluatory, indicating the scope or central thesis of the book as briefly as possible. The inclusion of a title at all is an indication that I consider it to have some measure of value and relevance for teachers of English in secondary schools.

Throughout, readers are bound to find omissions which seem to them serious: these may or may not be deliberate, and I should welcome correspondence on the subject as it may prove possible to publish a list of addenda at a later date.

I am grateful to Mr. Ian Michael of Bristol University for a number of valuable suggestions.

BIBLIOGRAPHIES AND BOOKS ABOUT CHILDREN'S BOOKS

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Eleven to Fifteen. A basic book list of non-fiction for secondary school libraries. School Library Association, revised 1957.

Modern Adult Fiction for School and College Libraries. N. CULPAN. School Library Association, 1955.

Children's Books of the Century. Library Association, 1958.

Chosen for Children. Library Association, 1957.

Books for Young People 11-13+. Library Association, 3rd edn., 1960.

Four to Fourteen. KATHLEEN LINES. Cambridge U.P., 1956.

Children's Books in England. F. J. HARVEY DARTON. Cambridge U.P., 2nd edn., 1958.

About Books for Children. DOROTHY NEAL WHITE. Cambridge U.P., New York, 1949.

Tales out of School. GEOFFREY TREASE. Heinemann, 1948.

A Critical History of Children's Literature. Ed. Carnelia Meigs. Macmillan, New York, 1953.

Twentieth Century Children's Books. F. EYRE. British Council: Longmans, 1952.

The 100 Best Books for Children. *Sunday Times*, 1957.

Recent Historical Fiction for Secondary School Children. K. CHARLTON. Teaching of History Leaflet 18. Historical Association, 1960.

Tellers of Tales. R. L. GREEN. E. Ward, revised 1946.

Books, Children and Men. HORN BOOK n.d.

Books for Children. P. PARROTT. National Book League, 1955.

The Unreluctant Years. L. H. SMITH. A.L.A. (Woolston), 1954.

Books for Young Readers. Second edn., revised and annual supplements. Woodfield and Stanley, 1956.

School Libraries. A short manual. C. A. SCOTT. Cambridge U.P., 1955.

Running a School Library. A. NEIL. Collins, 1957.

PERIODICALS

(Addresses are for subscription rather than editorial)

The Use of English. Ed. Denys Thompson. Chatto and Windus, 40, William IV St., London, W.C.2. Quarterly (17/6 p.a.)

Invaluable for its articles and reviews. The only journal published in this country devoted exclusively to the teaching of English.

English (Literature, Criticism, Teaching). The Journal of The English Association. Oxford U.P. Neasden, London, N.W.10. Quarterly (14/- p.a.)

Some useful articles and reviews.

The School Librarian. The Journal of the School Library Association. 29, Gordon Square, London, W.C.1. Thrice yearly (16/6 p.a.)

Particularly valuable for its reviews of children's books. The Association also publishes very useful bibliographical and other pamphlets.

Exercise Exchange. Rinehart and Co., 232 Madison Av., New York, 16. Quarterly (1 dollar p.a.)

An American journal "for the interchange of classroom ideas among teachers of composition and literature." Mainly High School and College level. Lively and practical.

The Critical Quarterly. Ed. C. B. Cox and A. E. Dyson. Oxford U.P., Amen House, Warwick Square, London, E.C.4. Quarterly (12/- p.a.)

Many of the articles could be useful at Sixth Form level. Mainly devoted to 20th Century Literature. Refreshingly unponderous for an academic journal and could help to keep the teacher in touch with the literary scene and critical trends.

College English. Published in America by The National Council of Teachers of English, 508, South Sixth St., Champaign, Illinois. Monthly from Oct. to May. (4 dollars p.a.)

The Council also publishes **The English Journal** which is mainly devoted to English teaching in junior grades.

In addition many literary and educational periodicals occasionally publish material specifically relevant to the Secondary School English teacher. The following are among the most useful:

The Times **Educational Supplement.**

The Times **Literary Supplement.**

The Listener.

Books. The journal of The National Book League. 7 Albermarle St., London, W.1.

British Book News. Published for The British Council, 65 Davies St., London, W.1.

Books and Bookmen. Hansom Books, 21 Lower Belgrave Street, Buckingham Palace Road, London S.W.1.

Plays and Players. Hansom Books (as above).

Drama. British Drama League. 9 Fitzroy Square, London, W.1.

Speech and Drama. Society of Teachers of Speech and Drama. Hon. Sec., Oakhurst, Steep, Petersfield, Hants.

Educational Theatre Journal. American Educational Theatre Association. Artcraft Press, 10 Watson Place, Columbia, Missouri.

World Theatre. Published in French and English by International Theatre Institute under the auspices of U.N.E.S.C.O. Olivier Perrin, 198 Boulevard Saint Germain, Paris.

Athene. Journal of the Society of Education through Art. 37 Denison House, 296 Vauxhall Bridge Rd., London, S.W.1.

The Poetry Review
The Voice of Youth } Published by the Poetry Society, 33 Portman Square, London, W.1.

Sight and Sound. Published by the British Film Institute, 164 Shaftsbury Avenue, London, W.C.2.

The London Magazine. 58 Frith Street, London, W.1.

The Twentieth Century. 26 Bloomsbury Way, London, W.C.1.

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The British Journal of Educational Studies. Faber and Faber.

The British Journal of Educational Psychology. Methuen.

Essays in Criticism. Blackwell.

LITERATURE AND EDUCATION (General)

English for Maturity. DAVID HOLBROOK. Cambridge U.P., 1961. Part I. English in the Secondary School. Part II. The Practice of Teaching English.

Written primarily for teachers in secondary modern schools who " are helping to train the sensibility of three quarters of the nation " and " create its capabilities for living and its potentialities as an audience for new forms of literary expression." Valuable appendices and bibliography.

The Use of Imagination: Educational thought and the literary mind. WILLIAM WALSH. Chatto and Windus, 1959.

The author's thesis is that the one essential professional qualification for a teacher is that he be educated and that no one can be considered educated who has not come under the supremely civilizing influence of literature. He discusses a series of educational themes through an examination of the work of Coleridge, Wordsworth, Hopkins, Twain, James, de la Mare, Lawrence and Eliot while not forgetting that literature is literature and not an illustration of educational ideas.

The Abolition of Man: Reflections on education with special reference to the teaching of English in the upper forms of schools. C. S. Lewis. Riddell Memorial Lectures 1943. Geoffrey Bless, 1947.

A most important discussion. The author points to the dangers of using a commonplace, destructive rationalism or the ill-digested methods of philosophical linguistic analysis to attack propaganda and other forms of persuasive and sentimental writing. The two books he examines pseudonymously are **The Control of Language,** Alec King and Martin Ketley, Longmans Green, first published 1939 and **The Reading and Writing of English,** I. A. Biaggini, Hutchinson, 1936.

Education and the University. F. R. Leavis. Chatto and Windus, 1943.

" A sketch for an ' English School '." Concerned with making the study of literature a discipline, not of scholarly industry and academic method, but of intelligence and sensibility. A most important contribution on a problem that concerns the secondary school teacher, who is largely bound by examination syllabuses, no less than the university don.

Theory of Literature. René Wellek and Austin Warren. Harcourt, Brace and Co., N.Y., 1942.

" . . . might have been called theory of Literature and Methodology of Literary Study." Attempts " to unite ' poetics ' (or literary theory) and ' criticism ' (evaluation of literature) with ' scholarship ' (' research ') and ' literary history ' (the ' dynamics ' of literature, in contrast to the ' statics ' of theory and criticism)."

The Education of the Poetic Spirit. Marjorie L. Hourd. Heinemann, 1949.

"A study in children's expression in the English lesson." The author is concerned with the place of imaginative experience through literature in the child's whole mental and emotional growth and discusses dramatisation and creative writing as well as the reading of literature. She is critical of some aspects of ' centres of interest ' methods and of A. J. Jenkinson's conclusions about children's reading. Her arguments are extensively illustrated from the work of girls in a Public Day School.

Coming into their Own. Marjorie L. Hourd and Gertrude E. Cooper. Heinemann, 1959.

" A study of the idiom of young children revealed in their verse writing." In her commentary on a collection of verse written by a class of ten-year-olds Miss Hourd links together problems connected with literature, pedagogy, and the psychology of child development.

Language and Reality. M. Hope Parker. Frederick Muller, 1949.

" A course in contemporary criticism." Concerned with the modern artist's attempt to rescue words and their capacity to mean from " the general mess of imprecision of feeling "; with " the relation between life and language; with the nature of values and the what, why and how of critical technique."

Culture and Environment. F. R. Leavis and Denys Thompson. Chatto and Windus, first edn., 1933.

"The training of critical awareness." A pioneering attempt to resist the increasing pressures of mass communication and industrial urban living in the interests of education.

Reading and Discrimination. Denys Thompson. Chatto and Windus, first edn., 1934.

Intended "to provide a start in the training of discrimination in reading, and in the forming of judgements at first hand, by the examination of some kinds of good and bad literary experience." The first and still one of the best attempts to apply I. A. Richards' ideas in "Practical Criticism" for classroom use.

The Critical Sense. James Reeves. Heinemann, 1956.

Practical criticism of prose and verse for sixth forms. Provides a brief background of critical theory and a glossary of literary terms with passages of prose and verse for study.

Fiction and the Reading Public. Q. D. Leavis. Chatto and Windus, 1939.

Concerned with "the fiction that does not happen to be, or to have become, literature as the novels which ultimately get into the text books," and which culturally is of the greatest importance. This study preceded the work of A. J. Jenkinson and Richard Hoggart (see Miss Bate's bibliography) and indirectly throws much light on the kind of reading children are likely to do outside the classroom.

The Seduction of the Innocent. F. Wertham. Museum Press, 1955.

A study by a psychiatrist of the effects of 'comics' on children in America.

Young Writers, Young Readers. Ed. Boris Ford. Hutchinson, 1960.

Part I. An anthology of children's writing. Part II. Essays by various hands mainly on writers and writing for children. Part III. A valuable list of recommended books for children.

The Importance of Illiteracy. M. M. Lewis. Harrap, 1953.

A shrewd analysis of a major social problem about which there is much confused thinking and anxiety within the teaching profession and by the public at large.

Reading English. Seary and Story. Macmillan, 1959.

Common sense advice to the freshman reading English much of which is applicable to sixth formers.

The Muse in Chains. Stephen Potter. Jonathan Cape, 1937.

"A study in Education." A revealing and witty historical survey of the study of English literature as an academic discipline with much shrewd criticism of its abiding absurdities.

The Active Teacher: Training and Assessment. J. ELIZABETH RICHARDSON. Routledge, 1955.

" The first part of the book is concerned with the handling of speech problems in general and the second part with the training of English specialists in particular . . . Emphasis has been laid on the role which a teacher plays in the classroom and on the way in which recording apparatus . . . enables the student to examine his own performance in this role."

Teaching English through Self-expression. E. J. BURTON. Evans n.d.

" A course in Speech, Mime and Drama ": the author believes that " speech and dramatic work should be a basis for written work and a stimulus to literary study."

English for Pleasure. L. A. G. STRONG. Methuen, 1941.

Based on a series of broadcast talks to schools which touch on many aspects of reading and writing.

Creative English. GORDON TAYLOR. Arnold, 1958.

POETRY

On Reading Poetry. AUBREY DE SELINCOURT. Phoenix House, 1952.

A short book written simply but without condescension by an outstanding teacher. Fresh, wise and persuasive, its great virtue is that it does not shirk the most difficult problems of definition.

Poetry and Children. Prepared by the Central Committee on the Teaching of English in the East and West Ridings of Yorkshire. Methuen, 1956.

Contains chapters dealing with ' teaching ' poetry to all age groups from the infants' school to eighteen, descriptions of various experimental methods of interesting children in poetry and some useful appendices.

Poetry for You. C. DAY LEWIS. Blackwell, 1944.

Written for children to accompany his anthology **The Echoing Green** but can well stand on its own. His answers to questions like " What is the use of poetry?" (Ch. I.) or " When is a poem not a poem?" (Ch. IX) are likely to be particularly useful to the teacher and the whole book could be used as the basis for discussion in class.

The Appreciation of Poetry. P. GURREY. Oxford U.P., 1935.

The book is " an investigation into the nature of ' appreciation ' of poetry, primarily for the guidance of students and teachers of literature." It exposes the unsoundness of the conventional methods of poetry teaching which relied on scansion exercises, rote learning, and learning the technical terms of prosody, verse forms and figures of speech and attempts to put something sounder in their place.

Poetry without Tears. Michael Baldwin. Routledge and Kegan Paul, 1959.

A forthright and often entertaining survey of the problems of selecting and presenting poetry to children. He argues that the surest road to appreciating poetry is through writing it and quotes a selection of children's work.

Poetry in the Sixth Form. Compiled by The Society for Teachers of English. Ed. George Whitfield. Macdonald, 1950.

" . . . the full appreciation of a poem demands an effort of attention which can be helped in various ways which are suggested in this book." A number of sample lessons are given. Useful bibliography.

Teaching Poetry. (Poetry in class, five to fifteen). James Reeves. Heinemann, 1958.

Part I contains chapters on the choice of poems and methods of presenting them to children of different age groups. Part II attempts to answer the question " Why teach poetry?" and comments on some of D. H. Lawrence's ideas about inspiration, the irrational and the sense of wonder.

Poetry in Practice. Some suggestions of teachers. Norman Callan. Ernest Benn, 1938.

Chs. 1-2, a discussion of the difficulties that appear in dealing with poetry for children. Ch. 3, a plan of reading and writing poetry for younger children. Chs. 4-6, more advanced study.

The Poets' Craft. A. F. Scott. Cambridge U.P., 1957.

" A course in the critical appreciation of poetry based on the study of holography manuscripts, earlier and later versions of printed poems, transpositions of prose into verse and contrasted translations."

Speaking Poetry. Geoffrey Crump. Methuen, 1953.

About those aspects of poetry that particularly concern the speaker including a chapter on the technical use of the voice. The author believes that " the arts can flourish only when there is a healthy tradition of interpretative as well as creative activity."

The Rudiments of Criticism. E. A. Greening Lamborn. Clarendon Press, Oxford, 1951.

Though originally published in 1916, it has a lot to recommend it still. " . . . a simply written introduction to the study of poetry such as might be put into the hands of young students to show them what to look for and to prevent them falling at the outset into the fatal error of reading poetry for the substance and not the form of its matter."

Poetry and the Teacher. T. W. Sussams. T. Nelson, 1949.

Discusses the teaching of poetry in schools and the place of poetry in education; offers suggestions for the improvement of techniques of presenting and choosing poetry for children in the light of surveys made by the author of children's opinions; attempts " to be as scientific as possible in what is, after all, largely an essay in aesthetics . . . where human factors are so inextricably entangled."

Approach to Poetry. JOHN F. DANBY. Heinemann, 1940.

Divided into three sections: The study of poetry; The doing and saying of poems; The study of poems. " It is often assumed that the poetry lesson calls for ' gush,' . . . actually the opposite is the case: the poetry lesson demands, if anything, a dry, wary, emotionally spare technique." Plenty of concrete examples of the kind of disciplined reading and activity on which the author believes true ' appreciation ' is built.

Adventure into Poetry. F. J. ARNSTEIN. Stanford University Press, California, 1951.

A book about the author's methods of enticing creative work from young children. Informed throughout by the conviction that " guided self-expression opens up important paths not only to cultural living but also to learning, to morality and to health."

The Criticism of Poetry. S. H. BURTON. Longmans, Green, 1950.

Based on the conviction that " true appreciation cannot be divorced from a knowledge of critical technique." The development of such appreciation and such technique is invariably accompanied by a growth in the power of self-expression, and a delight in the characteristic virtues of the English language." Deals with meaning, style, tone, intention, versification, prosody, diction and imagery with plenty of material for practice.

Feet on the Ground. An approach to modern verse. MARGARET J. O'DONNELL. Blackie, 1946.

" The aim of this book is to shift the emphasis from the poet to the reader of poetry." The attempt is to approach poetry " reasonably and scientifically, and as awareness grows, emotion is born, but it is a controlled emotion, because its cause is understood." Many poems are quoted in full and discussed.

The Apple and the Spectroscope. T. R. HENN. Methuen, 1951.

" Lectures on poetry designed (in the main) for science students." Based on short poems and passages " which lend themselves to a consideration of the kinds of values which could be readily related, in lectures, to ' the art of living '." This series of lectures met with an enthusiastic response from science students at Cambridge and should be suggestive of both methods and materials suitable for sixth formers studying non-literary disciplines.

The Anatomy of Poetry. MARJORIE BOULTON. Routledge, 1953.

Attempts to explain in a small compass all the useful technical terms with plenty of examples to avoid misunderstanding and to " be helpful to the examination candidate without killing poetry by an excess of formalism and pedantry."

The Discovery of Poetry. P. M. B. LYON. Arnold, 1930.

An elementary text book based on a series of broadcast talks. Though based on a rather unadventurous selection of poetry, it has stood the test of time quite well.

The Experience of Poetry in Schools. Ed. Victoria V. Brown. Oxford U.P., 1953.

On the Teaching of Poetry. Alexander Haddow. Blackie, n.d.

The Poetic Image. C. Day Lewis. Jonathan Cape, 1947.

The Clark lectures given at Cambridge, 1946. Not explicitly about teaching but more useful than many books that are.

Spoken Poetry in the Schools. Marjorie Gullan. Methuen, 6th edn., 1935.

PROSE

The Anatomy of Prose. Marjorie Boulton. Routledge, 1954.

A companion volume to " The Anatomy of Poetry." Attempts " to furnish some guidance to the elementary technical analysis of prose and to offer distinctions and definitions that give the student the possibility of saying something and, more important, wondering about something."

Understanding Fiction. Cleanth Brooks and Robert Penn Warren. Appleton Century Crofts. N.Y., 1934.

The authors believe that because most students voluntarily read a good deal of fiction, the art of fiction tends to be neglected by teachers of literature. Commentary and questions on a large selection of stories and excerpts arranged under the following headings: 1. The intentions of fiction; 2. How plot reveals; 3. What character reveals; 4. What theme reveals; 5. Special problems.

Reading a Novel. Walter Allen. Phoenix House, revised 1956.

An excellent brief introduction; the emphasis is on the recent novel in English. Seven novels from " Middlemarch " to " Lucky Jim " are discussed in the final chapter.

Reading for Vision. Kathleen E. Morgan. Arnold, 1953.

Emphasises the discipline as well as the delight of reading literature. Four introductory chapters followed by commentaries on the selection in " The Window of Prose."

An Introduction to the English Novel. Arnold Kettle. Hutchinson's University Library, 1951-3.

Vol. I. To George Eliot. Vol. II. Henry James to the present day. In each volume the author makes a shrewd and challenging analysis of a few significant works from a not inflexible Marxist standpoint.

The English Novel. Walter Allen. Phoenix House, 1954.

" A short critical history." In fact, amply detailed for sixth form work.

English Prose Style. HERBERT READ. Bell, 1949.

Part I. Composition. Part II. Rhetoric. Not an elementary book, but should be valuable for revealing the complexity involved in answering apparently simple questions like " What is prose? " and " What is style? "

The Craft of Fiction. PERCY LUBBOCK. Jonathan Cape, 1921.

An influential treatise which still makes fresh reading.

A Treatise on the Novel. ROBERT LIDDELL. Jonathan Cape, 1947.

Some Principles of Fiction. ROBERT LIDDELL. Jonathan Cape, 1953.

DRAMA

The Player's Library. Four volume catalogue of the British Drama League's Library. Faber and Faber, 1950-56.

A very comprehensive catalogue of plays and books on all aspects of drama.

The Guide to Selecting Plays. Part V. Handbook of Plays for Children and Youth Clubs. Samuel French, 1955-6.

Books and Materials for School and Youth Drama. JOAN M. COLLINS. Dobson, 1956.

Drama and Education. P. A. COGGIN. Thames and Hudson, 1956.

A scholarly historical survey from ancient Greece to the present day. The later chapters are likely to be particularly valuable for their survey of the relationship between drama and modern educational theory.

Child Drama. PETER SLADE. University of London Press, 1954.

A large, illustrated and somewhat effusively written book by a teacher of drama of undoubted originality and influence. Concerned primarily with mime, dance drama and all kinds of spontaneous dramatic play rather than with plays. His claim that child drama is an art form in its own right and the value of his methods have been substantiated by the work of many other teachers in recent years.

An Introduction to Child Drama. PETER SLADE. University of London Press, 1958.

A shorter account of the author's fundamental principles and methods.

Leap to Life. An experiment in youth drama. JOHN WILES and ALAN GARRARD. Chatto and Windus, 1957.

A stimulating account of the method of movement and mime to music (sometimes called Dance Drama) developed by Alan Garrard with children in secondary modern schools and youth clubs.

Shakespeare and the Young Actor. GUY BOAS. Rockliff, 1955.

A practical guide to production based on the author's work at Sloane School, Chelsea.

Shakespeare and the Classroom. A. K. Hudson. Heinemann, 1954.

Compiled for The Society for Teachers of English. Wittily argues the case for the ' acting ' or ' stage-centred ' method of approach (even when working for G.C.E. exams), rather than the more usual non-dramatic or ' construe ' method which treats children as textual scholars in embryo. Plenty of practical examples and useful appendices including a bibliography of the most useful books on Shakespeare and his background.

Moonlight at the Globe. Ronald Watkins. Michael Joseph, 1946.

An essay in Shakespeare production based on a performance of " A Midsummer Night's Dream " at Harrow School.

Going to the Theatre. John Allen. Phoenix House, 1949.

A book about the professional theatre written for children. One of the useful ' Excursions ' series for young people.

Dramatic Work with Children. E. M. Langdon. Dobson, 1948.

What can and should be done in dramatic work with children aged 5-14. A valuable short study.

Group Playmaking. Mary Kelly. Harrap, 1948.

Outlines the purpose and methods of encouraging children to make their own plays as a group activity.

Directing the Play. (A source book of Stagecraft). Ed. Toby Cole and Helen Chinog. Vision Press, 1954.

Essays by many hands on the art of the director in the theatre.

Drama in Performance. Raymond Williams. Frederick Muller, 1954.

Discusses and illustrates from specific plays a method of dramatic analysis and the relationship between text and performance.

The Anatomy of Drama. Marjorie Boulton. Routledge, 1960.

Intended to increase the understanding of drama among young people who do not have easy access to the live theatre and who therefore study plays chiefly as printed books. Suitable reading for older school children.

Theatre in the Round. Margo Jones. Rinehart, N.Y. 1951.

Not specifically about work with or for children but might be stimulating to the teacher who wants to break out of the picture-frame.

A Drama Teacher's Handbook. Pamela Blackie. Blackwell, 1956.

" This book has been written primarily to help teachers in institutes, schools and clubs who find themselves in positions of dramatic authority with only a modicum of stage experience behind them." Not the comprehensive manual its title suggests. A brief review of acting techniques with a series of exercises, mimes and ' snippet ' scenes.

Drama in Schools: Approaches, methods and activities. E. J. Burton. Herbert Jenkins, 1955.

One of a useful series of Practical Stage Handbooks (general editor: Harold Downs) covering most aspects of amateur dramatics. Contains chapters on " The Place of Drama in Education," " The School Play " and practical suggestions on methods and materials at all stages from the infants' school to the sixth form.

Classroom Dramatics. Rodney Bennett. University of London Press, 1938.

Practical advice on methods, materials and equipment for all kinds of dramatic work in the classroom from infancy to adolescence.

The Amateur Producer's Handbook. F. Sladen-Smith. University of London Press, 2nd edn., 1948.

Brief and practical.

Children and the Theatre. C. E. Fisher and H. G. Robertson. Stanford U.P. and O.U.P., revised 1950.

Concerned with selecting, casting, rehearsing, dressing, etc., plays by child actors for child audiences.

Theatre for Children. Winifred Ward. Children's Theatre Press, U.S.A., revised 1950.

Creative Dramatics. Winifred Ward. Appleton Century, U.S.A. n.d.

The development of children through the creating of original dramatisations.

Twenty-one Years with Children's Theatre. Charlotte B. Chorpenning. Children's Theatre Press, U.S.A., 1954.

A record of the author's experience in writing and producing for children in the theatre.

Drama in Schools and Youth Centres. G. H. Holroyd and Nora Ratcliffe. Macdonald, 1949.

Appraising a Play. Harold Downs. (Practical Stage Handbooks). Herbert Jenkins 1955.

Play Production with Children and Young People. John Allen. (Theatre in Education Series), Dobson, 1956.

Let's Do some Acting. Anthony Parker. Bodley Head, 1955.

Amateur Stage Handbook. P. Hamilton. Pitman, 1957.

Handbook for the Amateur Theatre. Ed. Peter Cotes. Oldbourne Press, 1957.